TK2305
W52

Western Electrician.

EVERY SATURDAY.

VOLUME XXV.

NUMBERS 1—27.

July 1—December 30, 1899.

ELECTRICIAN PUBLISHING COMPANY,
CHICAGO.

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EVERY SATURDAY.

Vol. XXV. CHICAGO, JULY 1, 1899. No. 1

THE CONVENTION

Of the Independent Telephone Association at Chicago, June 26th-28th.

The meeting of the Independent Telephone association at Chicago on June 26th, 27th and 28th proved to be the most important gathering of representatives of this industry that has ever been held. The attendance was large and of such a representative and substantial character that a favorable impression was made upon outsiders who had been attracted to the meeting. It is estimated that over 300 men participated who were directly interested in the independent telephone industry, and it may be looked upon as a significant fact that the list of delegates included representatives from 18 states. The proceedings were dignified and harmonious throughout, and the result cannot fail to benefit the association and the independent movement.

On Monday headquarters were opened at the Auditorium Annex, where the officers of the association received the delegates and held numerous conferences upon reports from all parts of the country. It was evident that the Bell interests had been stirring up the weaker members, as there were many anxious inquiries from representatives of companies whose field had been invaded.

Monday evening was given up to committee meetings, at which the work of the year was canvassed.

Tuesday's Proceedings.

The convention proper opened on Tuesday morning, in the banquet hall of the Auditorium Hotel. There were over 200 persons present when President Thomas called the meeting to order and opened the proceedings by reading the following address:

President's Annual Address.

This is our third annual meeting. I desire first to thank you for the many courtesies shown me as president of this organization and to bid you all a hearty welcome here. I desire especially to thank the other officers and committees for their support and valuable assistance at all times in carrying on the work which we have in hand.

I desire at this time to express for this body our heartfelt thanks and appreciation to the committees recently appointed, viz.: The committee on funds and publicity and the committee on entertainment, for their faithful and earnest work, which will make this the best of all our annual meetings; and to the manufacturers and supply men who have so liberally contributed to the entertainment fund. We desire to say that we will not leave you until we have conclusively proven that your hospitality is duly appreciated.

Men who have undertaken the organization of mutual interests scattered throughout the entire United States all agree that it is a task requiring much time and labor and incidentally a great amount of money.

We are therefore of the opinion that the indications here to-day in this, the third annual meeting of the Independent Telephone association, are not only very encouraging, but fraught with bright promise for great future success. This large meeting indicates more than this. It shows conclusively that the work accomplished in the last two years is appreciated.

We have further evidence of this approval in the large number of letters from those who cannot be with us, tendering their good will and expressing a desire that the organization go on to the accomplishment of greater things. We, who have had the affairs of this organization in hand as your representatives, feel great encouragement in all this, and we desire now to publicly express our thanks for this hearty co-operation and expression of good will. Many inquiries throughout the last year have reached the officers of this association as to its objects and ambitions. They have been answered, not always in the language of the constitution, but apparently to the satisfaction of those making inquiry. But I know of no clearer or more expressive language than that found in the constitution in Article II. as follows:

"The objects of this association shall be:

"Sec. 1. The protection of all independent telephone interests of common concern to the members of the association.

"Sec. 2. The protection of subscribers to telephones and apparatus operated by members of this association.

"Sec. 3. The bringing about of a reasonable charge for tolls and the rental of telephones, so that the telephone may be within the reach of the masses of the people.

"Sec. 4. The bringing about of a complete sys-

INDEPENDENT TELEPHONE ASSOCIATION.—DELEGATES ATTENDING CHICAGO CONVENTION.

tem of inter-municipal communication and long-distance trunk lines."

We have accomplished to a remarkable degree all the objects set forth, but have now reached a condition where there is greater demand than heretofore for a close organization which has at its command all the facilities and men necessary to meet the attacks of our opponents in their fight for existence in certain territory of the United States.

If one of our members is attacked, which is the latest resort of the opposition, with a hope of discouraging the officers and stockholders, with a view to purchase or procure a contract for connection, this association should be able, upon request, to place a working force under the control of such members to assist in resisting the efforts of the opposition.

This requires the services of experienced men who are familiar with Bell methods, who in a little time can turn Bell arguments to naught, in fact cause them to act as the boomerang.

As president of this association I have seen many gratifying results grow out of a letter which gave new hope and new ideas to the young company just fighting for existence, and often a letter to companies older in experience, advising them to stand firm and resist the seemingly kindly proposals of the enemy, have accomplished the object desired, and have been the means of keeping within our ranks those who otherwise might have turned to the opposition.

It is the desire of man in all pursuits to have some center, some head to instruct, guard and advise. We feel that our existence has demonstrated this truth and that now the numerous telephone interests are agreed that this organization be perfected and perpetuated.

We now need in each state an organization similar to the New State company of Mchigan, the New Long-distance Telephone company of Indiana, the United States Telephone company of Ohio, and other state companies, to connect up by first-class copper metallic circuits the local exchanges of the different states, upon an equitable basis. Their organization should be encouraged by the local companies and by the state association and should have the assistance and support of this general organization.

Then the state companies should join their wires, giving to us a complete long-distance system, so that words of good cheer can pass throughout the land from the strong to the weak.

We hail with delight the advent of better apparatus; and a trip through the factories, stores and exhibits to-morrow morning will convince you that long strides toward perfection have been made by the manufacturers since our meeting one year ago.

Financial.

In our former meetings, we have always considered ways and means of interesting large capital in this field.

Without very much organized effort through the attention of individuals large capital has become interested and the year just closing finds the independent telephone interest with sufficient capital at its command to carry on the work by the purchase of labor and material faster than they can be supplied. The factories without exception have increased their capacity and new ones have started during the past year.

In certain parts of the United States the rural districts are already well developed, and the work is going on throughout the entire country in the smaller towns and cities. The local company is not satisfied until every village, hamlet, postoffice and principal cross-roads is connected with its exchange by means of toll stations; while the universal experience of all companies has been that the demand of the farmer for telephone service at reasonable prices seems to be unlimited. The large cities are fast falling into line, and our hopes in this direction are being fully realized. The promise for the coming year in the large cities is very satisfactory.

We had at the time of our last meeting, according to our statistics, about 1,100 independent telephone exchanges in operation in the United States. The year just closing has started into operation more than 1,200 in addition thereto, making a total of more than 2,300 telephone companies under the independent system now in operation.

There are several hundred more in process of construction and a great number of companies which have franchises or are seeking franchises, which have not yet begun to build.

While the number of telephone exchanges more than doubled the past year the investment more than quadruples on account of the fact that larger exchanges, with more expensive equipment, were among the number of increase. We have now in operation many thousand miles of toll lines. The various independent companies are operating more than 575,000 telephones, not including those operated outside of public exchanges and toll-line companies. There is to-day already invested in independent telephone exchanges and toll lines more than $55,000,000, while many millions of capital are engaged in manufacturing and furnishing supplies to the operators.

Watered Stock of the Bell.

We do not claim to equal the Bell in amount of stock issued. We cannot make a $250,000 investment pay large interest upon a stock issue of $1,500,000, besides paying large salaries, but we can and do make a fair business interest for actual investment after providing for expenses and depreciation. Water is all right so long as you can make it carry you, but when the conditions shift, and you have to carry the water, then it becomes burdensome, and each day sees your strength failing, until finally you are crushed under the load.

Therefore, while water is a good thing in its place, and we heartily recommend it for certain purposes, nevertheless we advise total abstinence when it comes to stocks.

Much surprise is expressed throughout the country at the great success of the independent companies. Our neighbors thought we would certainly be swallowed up by the great monopoly, as it was called. But we have not been, but still live and flourish and our number is being multiplied.

Why Success Instead of Failure?

After the expiration of the basic patents and its monopoly of 17 years which our government seeks to give to the inventor (who rarely gains the object intended by our government), the people demanded cheaper telephone service, which was refused by the Bell company. Cheaper telephones were not only refused, but the same arbitrary rules were enforced against the people. The people grew tired and commenced to build and patronize independent telephone exchanges and are going to continue so to do until they possess the telephone field.

The independent telephone company which does not flourish will find the fault is not with the people, but with the management of the company's affairs.

But it is asked, Why did not the Bell company reduce prices? They did not because they could not. They could not because the parent Bell had tied the hands of the lessee companies so that they were to have paid more royalty per year upon each instrument than the instrument would sell for in the market.

They could not for the other reason that they had taken too much water in their younger days and they could not make the dividends go round at reasonable prices. They do reduce prices now, and have been for four years, 'tis true. They even give free telephones and in some instances free toll-line service; but it is only to crush the independents, which we are glad the people understand and do not indorse.

I know of some farmers who built their own telephone lines nearly twenty years ago, who paid to the Central Union Telephone company $10 per month for each instrument they used for the first two years, and after a long struggle succeeded in reducing the amount.

At the same time they were selling to a company of the farmers' neighbors, for use in South America, similar instruments for $10 each.

The wonder then is not that the independents succeed, but that any fail. None ever fail except those built with wind and watered stock. Place money, energy and honesty behind your proposition and the people will do the rest.

But these are not all their troubles.

Some of the sub-Bell companies have already laid down their burdens, which have been assumed by others, within the past year. We are told that one of the large sub-companies refuses longer to pay royalties, because of the expiration of the basic patents.

The Western Union Telegraph company, with several other plaintiff companies, has brought suit against the American Bell Telephone company under the Western Union-Bell contract, in which they seek an accounting in stocks and dividends amounting in the aggregate to about $10,000,000.

This suit not only directly affects the American Bell Telephone company, but also all its sub-companies' stock and holdings.

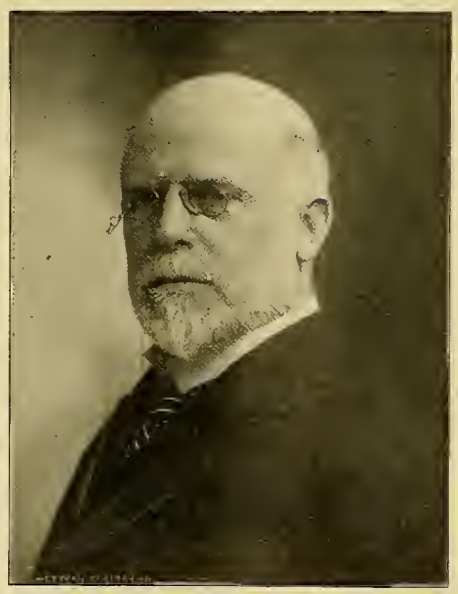
It will not be possible to go into detail in this address, but I desire to call your attention, in addition to what has already been said, simply as an illustration of the condition that exists wherever the independent companies have been active, to what we find in Central Union territory, composed of the greater parts of Illinois, Indiana and Ohio.

The Central Union, as they supposed, had this territory well developed; and with all their water, were paying fair dividends, five or six per cent. per annum.

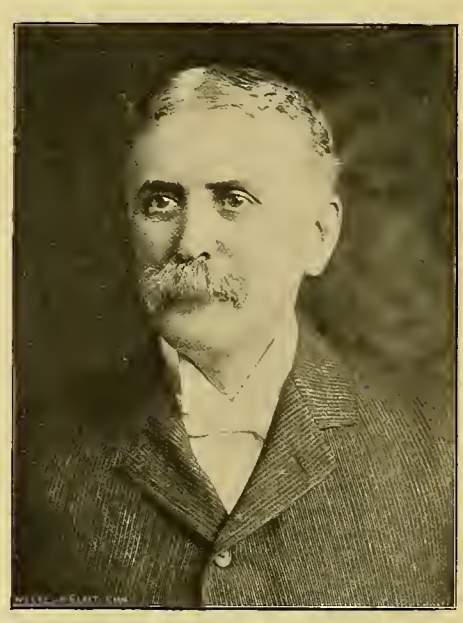
About four years ago they discovered they were experiencing some opposition and sought to crush it by reducing prices and later by giving free service in towns where the local companies existed. They found in most instances that their line work and equipment were old, and with it they were unable to compete with the service given by the new company. That which had answered the purposes of a monopoly would not do for competition, and so they needed money for the rebuilding of their old plants. So on the first day of July, 1896, they mortgaged their property to secure an issue of $3,000,000 of bonds, of which they issued $2,500,000. On the 22d day of April, 1899, this mortgage was refiled as a chattel mortgage in the state of Ohio, and, as is required by the Ohio statutes, an affidavit was made by William H. Henkle, giving the amount due on that date, under said mortgage, $2,537,500.

This mortgage secured an issue of bonds, and is

George W. Beers.



Simon P. Sheerin.



Hugh Dougherty.

INDEPENDENT TELEPHONE ASSOCIATION.—PROMINENT INDIANA DELEGATES.

made to the Illinois Trust and Savings Bank of Chicago, as trustee.

On the 2d day of January, 1899, the Central Union Telephone company gave another mortgage. This is made to the Old Colony Trust company of Boston, as trustee, and secures an issue of $6,000,000 in bonds.

This is a second mortgage and does not, as is generally supposed, take up the first mortgage, which has been refiled as above stated.

It was not intended that the first mortgage should be paid off, for by the terms of the second mortgage, page 24 of said mortgage, it is agreed that it is subject to the mortgage given to the Illinois Trust and Savings Bank, trustee. But the Central Union agrees on the same page that the other half million shall not be issued.

The mortgaged indebtedness of the Central Union, then, when all these bonds are disposed of, will be $8,500,000, with accumulation of interest.

If the contention of the Western Union Telegraph company and others in the Boston litigation is right, then I presume an equivalent of 20 per cent. of Central Union stock with accumulated dividends would be prior to these mortgages, thus increasing the liability of said company.

These mortgages cover all the property of the Central Union Telephone company, and according to the mortgage itself, covers 55 exchanges in Illinois, 41 in Indiana and 76 in Ohio, making a total of 172 exchanges. The average mortgaged indebtedness on each exchange is about $50,000. The independents have now in operation in these three states 420 exchanges, and while they have not placed opposition in all the towns operated by the Central Union, the number of towns left is not large, and the independents are working very hard to that end.

An average of seven-tenths of the pay business for the use of telephones is paid to the independent companies.

The decreased earnings of the Central Union are great, while at the same time their investment and expenses are increasing all the time.

I do not desire to draw conclusions, but only to state the facts. If men who are interested will take their pencils it will be an easy matter to figure conclusions.

The coming year no doubt will be one of interest and importance to both sides. We should be always ready and on the alert. Station your men in proper position. See that they are well-equipped, and have your gunners stand close by your guns.

Miscellaneous.

At the conclusion of this address it was decided to have it printed in pamphlet form and circulated in the interest of the movement.

The report of the secretary-treasurer, W. J. Vesey, was a voluminous document, and was referred to an auditing committee, consisting of Frank Beam, L. A. Frazee and J. B. Ware.

Announcement was made that members from Illinois, Indiana, Ohio and Michigan would hold meetings during the noon recess to select members of the executive committee and transact other business relating to their state organizations. Several members took occasion to speak of the necessity for building up strong state associations. Dr. Lumpkin said that the Bell company had bought out all the officers of the Illinois organization, with the exception of two, and that it was necessary to reorganize, if any serious attempt to fight the Bell was to be made.

An invitation was extended by the Sterling Electric company to the members to visit Sans Souci Park Tuesday evening. The company provided a special train on the elevated railway and secured admission for all delegates to the park.

The president called attention to the entertainment features provided by the local committee. He said that the arrangements reflected great credit upon the Chicago manufacturers, who had provided so liberally for the comfort and convenience of the members.

At the conclusion of the morning session the members assembled on the grand stairway in the rotunda of the Auditorium and were photographed. The accompanying picture is a reproduction of this photograph.

The afternoon was occupied with the reading and discussion of papers. The first of these was by S. P. Sheerin of Indianapolis, president of the New Long-distance Telephone company of Indiana, on "Value of Long-distance Toll Lines."

C. L. Boyce, manager of the Citizens' Telephone company of Grand Rapids, Mich., had been assigned the subject, "Operation and Maintenance," but he was unable to be present, and his place was filled by Mr. E. B. Fisher of the same company.

Maxime Reber, electrical engineer of the Cuyahoga Telephone company of Cleveland, O., submitted a very able paper on "Essentials of Telephone Construction."

The last paper was by Hon. H. D. Critchfield, counsel for the United States Telephone company of Ohio, and treated of "Development of the Independent Telephone Business."

Election of Officers.

A short business session was then held at which the following-named officers were elected:

President—James M. Thomas, Chillicothe, O.

First vice-president—Charles Flower, Detroit, Mich.

Second vice-president—I. A. Lumpkin, Mattoon, Ill.

Third vice-president—George T. Hewitt, Cedar Rapids, Ia.

Secretary-treasurer—S. P. Sheerin, Indianapolis, Ind.

First assistant secretary-treasurer—G. W. Beers, Fort Wayne, Ind.

Second assistant secretary-treasurer—S. E. Wayland, Wilkesbarre, Pa.

The advisory board for the ensuing year will consist of the following-named gentlemen: James M. Thomas, Chillicothe, O.; Simon P. Sheerin, Indianapolis; H. D. Critchfield, Mount Vernon; E. B. Fisher, Grand Rapids; Hugh Dougherty, Bluffton, Ind.; H. C. Young, Columbia, Pa.; W. B. Seaton, Ashland, Ky.; W. H. Durin, Cedar Rapids, Iowa; T. W. Sennott, Chicago.

The following-named gentlemen were selected by their respective states to serve upon the executive committee:

Illinois—J. S. McConnell, Chicago.
Indiana—George W. Beers, Fort Wayne.
Ohio—E. L. Barber, Wanseon.
Michigan—J. B. Ware, Grand Rapids.
Wisconsin—William Lohmiller, La Crosse.
Iowa—W. H. Durin, Cedar Rapids.
Pennsylvania—Colonel H. C. Young, Columbia.
Kentucky—W. B. Seaton, Ashland.
Kansas—W. K. Hewitt, Leavenworth.
Tennessee—F. F. Sapp, Nashville.

This concluded the programme for the business meeting, and the convention accordingly adjourned.

The city of Brookings, S. D., is arranging to install a municipal electric-light plant. J.

Convention Notes.

J. H. McGill, of McGill & Pomeroy, Chicago, was, of course, on hand.

A. V. Overshiner, of the Marion Telephone company of Marion, Ind., was on hand.

George W. Conover, the well-known electrical man, spent considerable time at the convention.

E. R. Grier of Chicago, western manager of the Bryant Electric company, found time to drop in at the convention.

Milo G. Kellogg, of the Kellogg Telephone and Switchboard company, was one of the notabilities of the convention.

A number of inquiries were made for Secretary J. P. Hutchings of the Kokomo Telephone and Electric Manufacturing company of Kokomo, Ind.

H. D. Critchfield.

Samuel E. Wayland.

E. B. Fisher.

J. D. Juvinall.

INDEPENDENT TELEPHONE ASSOCIATION.—PROMINENT CONVENTION WORKERS.

It is regretted that Mr. Hutchings could not find time to attend the convention and remind those at the meeting that Kokomo telephones were as good as ever.

The Chicago Telephone Supply company was represented by D. A. Briggs, who made many friends and incidentally did considerable business.

The United States Automatic Telephone Register company of Chicago exhibited its automatic telephone register, Dr. J. F. Wilson doing the honors.

J. G. Ihmsen, the popular representative of the Keystone Electric Telephone company of Pittsburg, was one of the conspicuous figures at the convention.

E. B. Overshiner, of the Logansport Mutual Telephone company, was, of course, on hand. No telephone convention would be complete without Mr. Overshiner.

The cable pole house and telephone-cable distributing boards manufactured by F. Bissell & Co. of Toledo, O., received considerable attention from

convention delegates. Owing to the rush of business in the establishment of the Bissell company the company was unable to send a representative to this convention.

J. E. Holyoke, of Holyoke & Holyoke, the telephone specialty manufacturers of Chicago, was favored with several nice orders from out-of-town telephone men.

Edward J. Hall, representing the Wilhelm Telephone Manufacturing company of Buffalo, was on hand Wednesday, explaining the merits of the Wilhelm instruments.

The American Electrical Works was represented by its Chicago men, F. E. Donohoe and E. H. Hammond, who explained the merits of the American wires and cables.

W. J. Barr, general manager of the Transmitter Manufacturing company of Grottoes, Va., and inventor of the Barr transmitter, attended the convention and made many friends.

President Charles Messer of the Dearborn Electric company, Chicago, spent considerable time at the convention, renewing old acquaintances and making many new friends for his company.

It was a matter of general regret that D. A. Kusel, of the D. A. Kusel Telephone and Electric Manufacturing company of St. Louis, one of the pioneer telephone men, could not attend the convention.

E. L. Clark, better known as "the popular pole man," was on hand to renew old acquaintances and increase the number of telephone men using his company's products. Mr. Clark was ably assisted by O. W. Smith.

Many inquiries were made for C. H. North, president of the North Electric company of Cleveland. The North apparatus is becoming better known every day and the company is finding it a difficult problem to keep up with the demand.

The Central Electric company of Chicago was represented by Secretary Chas. E. Brown, C. W. Cobb and F. M. Pierce. While the company had no exhibit at the convention, delegates and visitors were well entertained at the company's large store.

The Leschen-Macomber-Whyte company of Chicago was represented by F. B. Macomber and Geo. S. Whyte. Two more popular representatives it would be hard to find. The company distributed a very neat memorandum book, which was well received.

J. R. Wiley, western representative of the Standard Underground Cable company, was constantly on hand, impressing upon those at the convention the merits of the Standard wires and cables, which are used in some of the largest telephone plants in the country.

The W. & C. bipolar receiver, manufactured by the Couch & Seeley company of Boston, and illustrated in the Western Electrician of June 24th, created considerable talk among those at the convention. It was a pity that the company did not have an exhibit.

Although located in Chicago, Messrs. Maxstadt and Jones of the American Electric Fuse company could not possibly find time to attend the convention, as the demand for the American fuses has been so great that the company has been obliged to work day and night to keep up with its orders.

The Victor Telephone Manufacturing company of Chicago was represented by President W. T. Blaine, E. E. Yaxley and Frank Armstrong, who did the honors for the Victor company in a most creditable manner. Those who called at the Victor factory were well entertained by Messrs. Blaine and Yaxley.

Up to the last moment J. J. Nate, the popular telephone man of Madison, Wis., expected to be at the convention, but at the last moment he was obliged to give up the idea of attending the convention. It was too bad that Mr. Batchelder, also of the Standard Telephone and Electric company, was obliged to telegraph his regrets.

Perhaps no exhibit attracted more attention than that of the Illinois Electric company of Chicago. It was stated that, like the Illinois telephone apparatus, this exhibit was guaranteed not to be troubled with "cross-talk." The Illinois representatives were F. E. Healy, L. K. Cushing, Carl Keith, H. E. Adams and "Admiral" Dewey Newman.

In the literature distributed at the convention there were many pointed references to the new order of things and the ancient enemy. One that attracted a good deal of attention was a card bearing a "Bell," the old company's well-known mark—but the inscription was different, as will be seen by reference to the reproduction presented above.

The Stromebrg-Carlson Telephone Manufacturing company, with its famous "central-energy system," was everywhere in evidence at the convention. The firm was represented by President A. Stromberg, General Manager Henry Shafer, L. G. Bowman and P. H. Hertz. It is no wonder the Stromberg-Carlson company has more work than it can handle, with such an efficient corps of representatives.

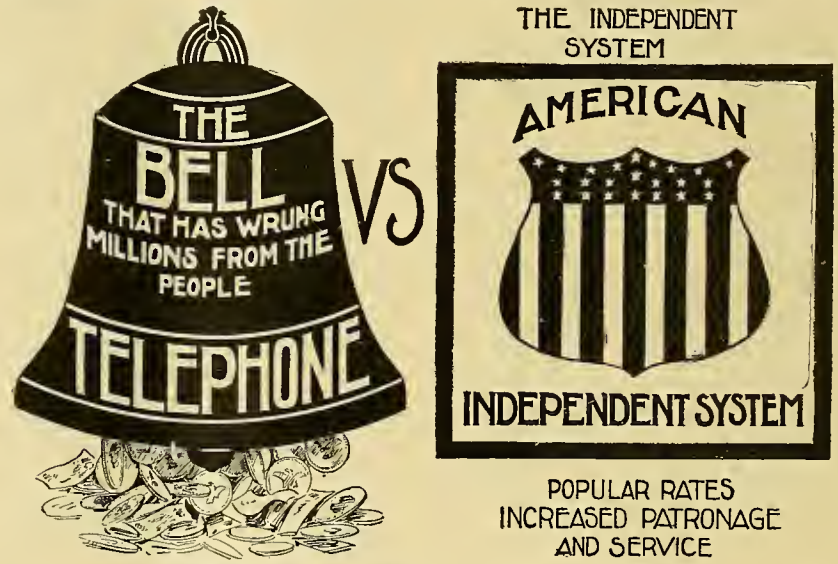
The Moon fuse terminal and other appliances for the protection of telephone cables from lightning attracted considerable attention at the convention. These devices are in general use throughout the country, and it is claimed that there is not a single instance on record where a telephone cable has been damaged by lightning or high-potential currents where the Moon fuse terminal was used.

Many queer things happen in the course of a lifetime, yet one may be pardoned for expressing surprise at the radical change in the attitude of such an earnest exponent of Bell principles as Mr. Fred De Land, who is now a full-fledged independent "magnate." Mr. De Land is president and treasurer of several companies, and is now forming a syndicate to control the lines of 12 independent exchanges in Pennsylvania.

The Electric Appliance company of Chicago was represented by S. A. Dinsmore, S. A. Rall, A. L. Millard, B. B. Downs and W. P. Upham. This energetic staff took every opportunity to impress visitors to the convention with the merits of the Electric Appliance company's telephone apparatus and construction material. Two of the representatives wore badges—one a very small one and another extremely large—to show what the Electric Appliance company was and what it is now.

The Sterling Electric company of Chicago was everywhere in evidence at the convention and spared no pains in entertaining the delegates and visitors. The company was ably represented by F. B. Cook, W. E. Doolittle, F. J. Tompkins, and, last, but not least, by its good-looking messenger, George Metcalf. At the invitation of the Sterling company about 200 members and visitors were entertained at Sans Souci Park on Tuesday evening.

C. W. Farr, president of the Farr Telephone and Construction Supply company of Chicago, managed to spend a few minutes among the convention delegates. The Farr company has done so large a business that its entire force has been taxed to its utmost. Many delegates and visitors took occasion to drop in at the Farr establishment, where they were welcomed by Mr. Farr and well taken care of by General Manager Hurst.



INDEPENDENT TELEPHONE ASSOCIATION.—THE OLD AND THE NEW.

The National Automatic Telephone company of Chicago, manufacturer of the well-known National system of automatic telephony, made an elaborate exhibit at the Great Northern Hotel. It consisted of a full line of instruments for both large and small exchanges; in fact, the company showed a model exchange, which attracted much attention. The many visitors who called at the Great Northern to examine the National system were well taken care of by Superintendent F. A. Lundquist, J. A. Russell and J. D. Norstrom.

James E. Keelyn, H. C. Dodge and J. G. Nolen are three of the best-known men in the independent telephone field. They represented the Western Telephone Construction company of Chicago, and that they performed their work well goes without saying. A large number of delegates visited the Western company's factory and were pleasantly entertained. This company made no exhibit at the Auditorium, but its large factory proved a sufficient attraction to draw a number of the members and visitors of the association.

Such an important concern as the American Electric Telephone company of Chicago had naturally a large staff of representatives at the independent telephone convention, and the efficiency of its members comported well with the size of the delegation. The "boys" who circulated among the delegates and dilated on the advantages of the American apparatus were Messrs. P. C. Burns, Eugene L. Brown, S. J. Baer, S. W. Moon, J. J. Speed, H. B. McMeal, W. P. Booth and W. L. Dolman. Their efforts to increase the prestige of their company and secure the actual sales of American apparatus were notably successful.

Many " old timers" who have seen years of service as Bell managers and superintendents and electricians, and almost everything else in the list of officers, with bigger titles than salaries, are now engaged in the independent movement. There were many familiar faces in the throng at the Auditorium during the convention, including some who had won considerable prominence during their service with the Bell interests. Among these might be mentioned Messrs. Brennan, Kellogg and Cook. Judge Thomas, the president of the association, was at one time retained by the Bell interests to look after their litigation in his section of the country.

One of the articles exhibited at the convention which attracted attention was the Smith adjustable universal square telephone arm, which is being placed on the market by Theodore Smith of Chicago. Although practically a new article, the demand for it has already exceeded expectations. Mr. Smith is about to place on the market the handy incandescent electric-light bracket, which works on the same principle as the telephone arm. This bracket is especially adapted for telephone switchboards, as it enables the operator to turn the light in any direction, and even behind the switchboard when an examination is desired to be made there.

Many prominent exchange managers, construction men and capitalists attended last week's meeting. In the Michigan delegation Mr. E. B. Fisher of Grand Rapids was one of the most energetic and enthusiastic workers. Mr. Fisher has been a member of the advisory board and has contributed valuable service. J. D. Juvinall of Upper Sandusky may be said to have represented the construction interests of Ohio, while H. D. Critchfield represented the exchange owners of the same state. Both are actively engaged at the present term in extending the independent lines in Ohio. Samuel E. Wayland, of the Pennsylvania delegation, was one of the most popular delegates. He reported a lively interest among independent exchange owners in his neighborhood. The companies are forming closer alliances than formerly. Indiana had a strong representation, including Simon P. Sheerin of Indianapolis, Hugh Dougherty of Bluffton and George W. Beers of Fort Wayne. They are all experienced business men and enjoy the confidence of the community.

Convention Exhibits.

One of the most interesting features of the convention was the exhibits. The rooms in which the exhibits were shown were always thronged with visitors who took the opportunity to examine the various apparatus displayed. Few Chicago houses made exhibits at the convention. All of them, however, made arrangements to entertain any visitors who called at the various factories, where special provision was made to entertain properly the large number of delegates and visitors. Manufacturers who went to the trouble to exhibit their goods probably received more direct returns from this convention than any previous meeting at which they exhibited. Pictures of several of the exhibits are given, and the following are brief descriptions of the more prominent ones:

Central Telephone and Electric Company, St. Louis.—The exhibit of the Central Telephone and Electric company was one of the most conspicuous at the Auditorium, and was personally looked after by President James S. Cuming, who was always on hand to explain the workings of the Central's products. The exhibit consisted of telephones, magnetos, receivers and other telephone parts, and received critical inspection. Mr. Cuming states that his apparatus is daily increasing in favor and that the company is doing a larger business than ever before.

Commercial Electrical Supply Company, St. Louis, and **United States Telephone Manufacturing Company.** St. Louis.—The two concerns named made a combined exhibit in a room directly off the convention hall and exhibited various styles of telephones and everything needed in the construction of

an exchange. The Commercial Electrical Supply company was represented by C. W. N. Money, who made another record for himself in looking after the interests of his company at this convention. Not only did Mr. Money explain the merits of the goods handled by the Commercial company, but he also found time to look after the interests of a large number of his customers, besides making many new customers and friends. The United States Telephone Manufacturing company was represented by President Frederick A. Churchill, Jr. This, being a new company in the telephone field, naturally attracted considerable attention. Mr. Churchill states that his company is ready to attend to the needs of telephone managers and is in a position to supply their demand for telephone apparatus. Mr. Churchill is well known to the telephone and electrical trades, and a more genial representative could not be found at the convention.

Ericsson Telephone Company, New York city.—Messrs. Smith, Wells and Miller were in charge of the Ericsson exhibit, which contained a large number of handsome patterns of the Ericsson desk sets, transmitters and telephones. The beauty of the Ericsson apparatus attracted universal attention, and few visitors departed without learning the special claims made for this well-known type of telephone apparatus. The Ericsson company also had on hand a number of its agents, who worked indefatigably among the delegates. The interest shown in the Ericsson apparatus should certainly result in increasing the demand for it.

Eureka Electric Company, Chicago.—Doubtless the largest and most comprehensive exhibit at the convention was that of the Eureka Electric company. The exhibit contained the well-known Eureka switchboards and the company's various styles of telephones and other appliances used in a telephone exchange, which were critically examined by a majority of the visitors to the convention. Many prospective customers called at the Eureka exhibit, where almost the entire Eureka staff was on hand to look after the interests of the company. The following-named representatives did the honors for the company: I. J. Kusel, A. Stein, C. B. Miller, M. McNeil, Jr., and H. J. Kusel. The Eureka company took many orders for its apparatus, besides selling everything exhibited at the convention.

Harvard Electric Company, Chicago.—Among the displays at the Auditorium Hotel during the convention there was no exhibit that attracted more attention than that of the Harvard Electric company. It was the first time in the history of telephone conventions that there was made an exhibit of telephone lightning arresters, cable heads, cross-connecting and distributing boards exclusively. The Harvard Electric company manufactures exclusively the Standard patent fuse, fusible cut-outs, center-plate and carbon lightning arresters, cable heads and distributing boards, all of which were shown at the convention. The display was presided over by Manager Frederick Greer, with the assistance of A. J. Kusel, who explained the strong points of the Harvard company's apparatus, and from the number of visitors at the display one could readily see that independent telephone users are beginning to learn that good protection from lightning is now a necessity. The company reports a remarkable run of goods of its manufacture, the factory running day and night.

National Carbon Company, Cleveland.—This company was the only carbon company to make an exhibit, and it made a very complete and excellent display. The exhibit was in charge of F. H. Murray, and consisted of over 30 styles of wet batteries, five styles of dry batteries, samples of granular and globular carbons for telephone transmitters, over 60 styles of back plates for telephone transmitters, diaphragms of all kinds, and other products. The room in which this display was made was nearly always filled with interested visitors, who were gracefully entertained by Mr. Murray.

The W. F. Warner Company, Muncie, Ind.—The Warner telephone generator, manufactured by the Warner company, was inspected with interest by many telephone managers and others. The exhibit was in charge of T. W. Warner, who explained the workings of the generator to a large number of interested visitors. This generator has now been perfected and is in use all over the United States. It is said to fill a real need, as it takes the place of hand generators for ringing up subscribers, especially in smaller exchanges. The instrument is mounted on a marbleized slate base and all parts are finished in black enamel and nickel plate. The cabinet in all occupies a space of 15 by 18 inches and is 36 inches in height. The machine is suitable for large and small exchanges, and it is stated that there is practically no limit to the number of subscribers that may be signalled at the same time. The Warner company is constantly receiving testimonial letters from those who have been benefited through the use of its instrument.

Williams-Abbott Electric Company, Cleveland.—The Williams-Abbott company was represented by President L. Sands, who personally described the fine points of the Williams-Abbott apparatus. Mr. Sands had on hand various forms of the Williams-Abbott magneto bells, transmitters and other telephone parts which have given such general satisfaction to users. The Sands bipolar receivers, both Standard and Pony type, were also exhibited and were closely investigated. The room in which the Williams-Abbott exhibit was made was well filled with interested visitors, who were well taken care of by Mr. Sands.

1. Williams-Abbott Electric Company.
3. Harvard Electric Company.
6. { Ericsson Telephone Company. / William F. Warner Company.

4. Central Telephone and Electric Company.

2. { Commercial Electrical Supply Company. / United States Telephone Manufacturing Company.
5. Eureka Electric Company.
7. National Carbon Company.

CONVENTION EXHIBITS.

Williams Electric Company, Cleveland.—President J. A. Williams and Burt Hubbell of the Williams Electric company were in charge of this company's exhibit, which was shown on the banquet-hall floor. The exhibit contained the various forms of telephones and magnetos manufactured by the company and used throughout the country. Messrs. Williams and Hubbell always had large audiences, who paid the closest attention to the strong points of the Williams apparatus. The company distributed its miniature catalogue, containing a scientific description of its apparatus. It was stated that the representatives of the Williams company returned to Cleveland with a number of nice orders secured at the convention.

The Chicago, Milwaukee and St. Paul Railway company has revived its plan of substituting electric power for steam locomotives on its suburban line between Chicago and Evanston. The distance is 12 miles, and it is possible that a connection will be made with the North Side elevated electric railway, by which the Evanston trains of the Chicago, Milwaukee and St. Paul company shall use the elevated structure now building and run around the Union Loop. The City Council is considering the railroad company's application for permission to use electric power on its Evanston route.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

Southern Telephone association, Memphis, Tenn., July 5th.

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 17th to 21st.

Chicago Exposition of Electrical Arts, Tattersall's, September 25th to October 9th.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

If the ladies take up the horseless carriage with enthusiasm, who can stay the development of the new vehicle? And if the automobile serves to attract attention to the stylish millinery of its fair occupants, will not the ladies be enthusiastic in its patronage? This line of thought is induced by the advertisement of "the automobile hat" by a prominent New York firm of retailers. This hat, say the advertisers, is "our own original creation, designed especially for wear in the automobile carriage—the newest and most stylish hat of the season." After this, who shall say that the automobile has not come to stay?

Objection is made to the practice of requiring payment in advance for goods sent to foreign countries by American manufacturers. It is said that while trade in some lines of American manufactures, particularly electric motors and other electrical apparatus, has been increasing perceptibly in the consular district of Prague, Austria-Hungary, the system followed by our manufacturers should undergo material changes if they intend to compete in that market. It is contended that United States manufacturers should treat business men and houses there in the same manner as they treat them at home; that is to say, if the manufacturer in the United States is placed in correspondence with entirely responsible houses in Austria-Hungary, which show a disposition to try an American article and are desirous of obtaining a sample (not as a loan, but for purchase), it will not do for the American manufacturer to write that it is his custom not to ship to that country unless the money be first deposited to his credit. It is pointed out that this only creates suspicion in the minds of business men there, aside from the fact that no good house will entertain the idea of doing business on such a principle. It is suggested that the American manufacturer who desires to enter the Austrian market send a salesman conversant with the language and sell to the houses direct, for business men there calculate as closely as they do in this country and are adverse to paying a middleman. There is not as much risk by a seller to be taken there as there is in the United States, for there are no exemption laws, and the financial standing of firms can easily be ascertained. Austria-Hungary is becoming a good market for electrical machinery, the imports in this line from the United States amounting in value to $38,492 during the last fiscal year.

The convention of the Independent Telephone association in this city, which has just closed, was in many respects the most important event in the history of the movement. The meeting was harmonious throughout and tended to promote a better feeling between the several elements that have heretofore been regarded as representing conflicting interests. There was not a single discordant note during the convention, and as a result the impression made upon the public was much more favorable than that of any former gathering. It must be admitted that in point of character and stability the attendance at the meeting just closed was superior to former conventions. The interests represented, too, were of a different character. It is well known that several of the gentlemen who participated in the proceedings were attracted to the convention by the desire to study the men associated in the movement, and thus form an estimate of their reliability, based upon personal observation.

The work of the association should have a lasting effect upon the industry. There seems to be a general awakening to the fact that better material and workmanship must be put into construction work to insure permanent success. This idea was encouraged by the convention leaders at every opportunity. The papers and discussions invariably advocated improvements all along the line, and the manufacturers heartily concurred in the sentiment which proved so popular among the exchange managers.

The action of the association in re-electing President Thomas was a graceful compliment to a hard-working officer, who has zealously guarded the interests of the association from the start. It is only fair that those who have stood by the organization in the trying times of its first years should reap whatever glory and honor it may now be able to confer. We believe that the present administration will make the association even stronger than before. The acquisition of Mr. Sheerin as secretary and treasurer secures for the organization the services of an experienced and able man, whose prominence in the community cannot fail to prove advantageous to the movement.

The Western Electrician feels that it can consistently renew its congratulations to the independent movement and the association particularly.

A tunnel scheme that is worth talking about—on paper at least—has been introduced in the shape of an ordinance in the Chicago City Council, presented by Alderman John Powers, the experienced legislator of the council. It appears that a certain Chicago Subway, Arcade and Traction company proposes to construct, maintain and operate in the city of Chicago, for a period of 94 years, a system of subterranean ways and arcades, tunnels and conduits under any or all streets, avenues, alleys, courts, parks, public grounds, rivers, canals, slips and docks. In this ambitious tunnel system the company asks permission to operate street cars, and to lay water, drainage and gas pipes and electric wires, pneumatic tubes, pipes for steam heat and a high-pressure water system.

The ordinance grants permission to the company to construct a terminal station, with elevators and entrances, under the city land lying between Randolph street on the north, the right-of-way of the Illinois Central railroad on the east, Monroe street on the south and Michigan avenue on the west. This is a pleasing site on the Lake Front Park in the heart of the city. As compensation for the use of this land, the ordinance provides that the company shall pay an annual rent equal to five per cent. of the valuation of the land. The compensation fixed by the ordinance for the right to build and operate the subway system is two per cent. per year on the gross earnings of the company in addition to the five per cent. of the value of the city land.

According to the ordinance permission is also given to the company to maintain and operate, at the expense of the company, a system of sewers placed at a lower level than the sewers of the city, to collect sewage and garbage in the district occupied by the system of the company, the sewage and garbage to be treated in reduction works to be operated by the company, presumably to be transformed into fertilizing compounds. All tunnels and arcades to be built are to be at least 18 feet in width and 13 feet in height, and the crowns of tunnels built under the Chicago River must by the ordinance not be less than 26 feet below city datum.

One section of the ordinance gives the company the right to construct a system of conduits and lower-level sewers for the purpose of providing for gas and high-pressure water mains, electric wires and cables, telephone and telegraph wires, pneumatic tubes and light, heat, power and other systems before constructing its subways for intramural railways. The ordinance likewise grants permission to the company to rent space in the conduits, arcades, subways and galleries to other corporations.

The ordinance requires the company to begin construction within one year from the passage of the ordinance, and at least seven miles of the whole shall be completed within five years. Section 13 of the ordinance provides that the compensation to the city for the privileges granted shall be paid for a period of 10 years after the passage of the measure, and provision is made giving the city the right to purchase the entire plant, property, franchise and business of the company at any time after the expiration of 30 years. The company is required to put up a bond of $250,000.

It will be seen that few possibilities in the subway business are overlooked. Alderman Powers seems to think that the street-railway companies are clamoring for this ordinance, and he is also credited with the statement that $250,000,000 of capital is behind the measure. The ordinance was referred to the judiciary committee.

As might be expected, the proposition is looked upon with suspicion, although there is urgent demand for relief in the downtown business district, which many experts declare can only be secured by the building of a comprehensive tunnel for surface lines. The present movement is looked upon as a grab-measure intended to preempt for the benefit of the gang whatever privileges may be available under such a franchise. Of course, such an ordinance cannot command the support of the community.

At a meeting of the judiciary committee later in the week it was decided to indefinitely postpone consideration of the Powers subway ordinance. However, it was recommended that the city advertise for subway franchise bids early in the fall.

Convention Attendance.

Following is a list of the convention delegates and visitors, taken from the official register of the association:

James M. Thomas, president Independent Telephone association, Chillicothe, O.
W. J. Vesey, secretary-treasurer Independent Telephone association, Fort Wayne, Ind.
Charles H. Schweizer, La Crosse and Southeastern Telephone company, La Crosse, Wis.
D. D. Mitchell, Martinsville Telephone company, Martinsville, Ind.
R. E. Connelly, secretary New Harrison Telephone company, Toledo, O.
A. H. Reutinger, Home Telephone company, Chillicothe, O.
H. C. Young, Columbia Telephone company, Columbia, Pa., and People's Telephone and Telegraph company, Lebanon, Pa.
S. A. Dinsmore, Electric Appliance company, Chicago.
H. B. McMeal, American Telephone, Chicago.
H. D. Critchfield, Columbus Citizens' Telephone company, Columbus, O., and Mount Vernon Telephone company, Mount Vernon, O.
F. R. White, Electricity, New York.
Arthur Stein, Eureka Electric company, Chicago.
Hugh Dougherty, United Telephone company, Bluffton, Ind.
J. G. Ihmsen, American Electric Telephone company, Chicago (Keystone branch), Pittsburg, Pa.
E. B. Overshiner, Logansport Mutual Telephone company, Elwood Telephone company, Marion Telephone company, Winamoe Telephone company, Kewanna, Ind.
Charles G. Cockerill, Jefferson Telephone company, Jefferson, Ia.
J. V. S. Church, Electrical World and Engineer, Chicago.
L. Sands, Williams-Abbott Electric company, Cleveland, O.
P. C. Burus, president Citizens' Telephone company, Muskegon, Mich.
M. A. Charlton, manager Bucyrus Telephone company, Bucyrus, O.
W. E. Doolittle, Sterling Electric company, Chicago.
E. H. Hammond, American Electrical Works, Chicago.
George F. Stitch, American Electric Telephone company, Chicago.
William E. Nicholson, Home Telephone company, Crawfordsville, Ind.
J. C. Landes, president Keystone Telephone and Telegraph company, Norristown, Pa.
Stephen H. Goddard, Electrical Review, New York.
Fred Deland, Pittsburg, Carnegie Telephone company, Latrobe Telephone Exchange company, Panhandle Telephone company, Leechburg Telephone company, Canonsburg Home Mutual Telephone company, Washington Home Mutual Telephone company, McDonald Home Mutual Telephone company and others.
J. A. Williams, president Williams Electric company, Cleveland, O.
E. B. Fisher, Citizens' Telephone company, Grand Rapids, Mich.
L. C. Cole, Bowling Green, O.
S. E. Wayland, Wilkes Barre, Pa., People's Telephone syndicate, Wilkes Barre; the Lackawanna Telephone syndicate, Scranton.
F. A. Lundquist, the National Automatic Telephone company, Chicago.
J. M. Oversbiner, Elwood Telephone company, Elwood, Ind.
George S. Whyte, secretary Leschen-Macomber-Whyte company, Chicago.
Frank E. Colbert, Electrical Review, Chicago.
C. E. Kammeyer, Telephone Magazine, Chicago.
P. J. Hertz, Stromberg-Carlson Telephone Manufacturing company, Chicago.
Henry Shafer, Stromberg-Carlson Telephone Manufacturing company, Chicago.
C. W. Odell, Odell Telephone Exchange and Toll Lines, Mowloqua, Ill.
C. D. Juvinall, Upper Sandusky, O.
Thomas W. Sinnott, United Telephone, Telegraph and Electric company, Chicago.
M. McFarlin, Mutual Telephone company and Central Telephone company, Des Moines, Ia.
George W. Beers, president National Telephone and Telegraph company, Fort Wayne, Ind.
S. F. B. Morse, Chicago.
James Wolff, New York Insulated Wire company, Chicago.
Frank Armstrong, president Armstrong Construction company and director Calhoun County Telephone company, Battle Creek, Mich.
A. N. Wilcox, director Paulding Telephone company, Paulding, O.
O. K. Dickinson, secretary Paulding Home Telephone company, Paulding, O.
Charles Butridge, manager the Tecumseh Telephone company, Tecumseh, Mich.
J. E. Keelyn, president Western Telephone Construction company, Chicago.
S. P. Sheerin, New Long-distance Telephone company, Indianapolis, Ind.
S. J. Bear, Phœnix Telephone company, Topeka, Kan.
C. A. Eisenhart, York Telephone company, York, Pa.
George B. Reedy, York Telephone company, York, Pa.
H. C. Dodge, Western Telephone Construction company, Chicago.
D. McVichie, Marquette County Telephone company, Ishpeming, Mich.
M. G. Kellogg, Kellogg Switchboard and Supply company, Chicago.
C. W. N. Money, St. Louis, Mo.
F. A. Churchill, Jr., United States Telephone Manufacturing company, St. Louis, Mo.
Phil Adler, Lebanon, Ind.
H. G. Mutuany, Lima Telephone company, Lima, O.
J. F. Maisen, Wapakoneta Telephone company, Wapakoneta, O.
J. J. Speed, American Electric Telephone company, Chicago.
H. E. Matthews, Huntington, W. Va.
Max Silberberg, Anthony company, Cincinnati, O.
Charles Flowers, Detroit Telephone company, Detroit.
L. A. Frazee, Connersville, Ind.
W. H. Durin, Cedar Rapids and Marion Telephone company, Cedar Rapids, Ia.
A. T. Averill, Cedar Rapids and Marion Telephone company, Cedar Rapids, Ia.
C. H. Inmay, Washington Court House, O.
E. Humphrey, Pike County Telephone company, Omega, O.
Carl C. Curtis, Sandusky Telephone company, Sandusky, O.
H. E. Ralston, Hamans Telephone company, Maryville, Mo.
P. L. Bohart, Hamans Telephone company, Maitland, Mo.
W. H. Orr, local manager Citizens' Telephone company, Holland, Mich.
Thomas Fricker, president Ashtabula Telephone company, Ashtabula, O.
A. Button, Painesville, O.
R. M. Smart, Painesville, O.
W. H. Holland, Holtzer-Cabot Electric company, Boston.
W. H. Flidderjohann, Inland Telephone company, New Knoxville, O.
Bert Teale, Lamoni Telephone exchange, Lamoni, Ia.
W. A. Hopkins, Lamoni Telephone exchange, Lamoni, Ia.
H. K. Cole, Owensboro-Harrison Telephone company, Owensboro, Ky., and Green River Telephone and Telegraph company, Henderson, Ky.
J. G. Taylor, Henderson Telephone company, Henderson, Ky., and Morganfield Telephone company, Morganfield, Ky.
C. A. Reeve, manager Plymouth Telephone company, Plymouth, Ind.
Dr. D. C. Knott, president, Plymouth, Ind.
W. H. Antram, manager Valley Telephone company, Lebanon, O.
F. G. Auton, superintendent Valley Telephone company, Lebanon, O.
T. E. Cory, Hoopeston, Ill.
George W. Russell, Wellsburg, W. Va.
Fred J. Bollmeyer, Northern Construction company, Bryan, O.
W. B. Scaton, Citizens' Telephone company, Ashland, Ky., and Lawrence Telephone company, Ironton, O.
L. D. Passano, Pittsburg and Allegheny Telephone company, Pittsburg, Pa., and Maryland Telephone company, Baltimore, Md.
J. S. McConnell, United Telegraph, Telephone and Electric company, Chicago, Ill.
Dr. I. A. Lumpkin, Mattoon, Ill.
Ez M. Harwood, Shelby County Telephone company, Shelbyville, Ill.
William Robinson, Citizens' Telephone company, Muskegon, Mich.
J. T. Millmann, National Telephone company, St. Johns, Mich.
L. S. Burk, American Electrical Engineering association, Chicago.
Charles E. Drew, Bunker Hill Telephone company, Bunker Hill, Ill.
H. F. Wellman, Citizens' Telephone company, Ashland, Ky.
A. S. Wellman, People's Telephone company, Catlettsburg, Ky.
George W. Fair, Schance & Fair Electric company, Chrisman, Ill.
J. G. Schance, Schance & Fair Electric company, Chrisman, Ill.; also Schance Telephone company, Sadell, Ill.
Charles E. Fair, Schance & Fair Electric company, Chrisman, Ill.
Milton I. Baird, Maryland, Pennsylvania and West Virginia Telephone and Telegraph company, Connellsville, Pa.
J. W. Place, Citizens' Telephone company, Decatur, Ill.
F. M. Schirmeyer, Citizens' Telephone company, Decatur, Ind.
C. E. Koontz, Bremen Telephone company, Bremen, Ind.
Albert Emanuel, Home Telephone company, Dayton, O.
F. G. Withof, Home Telephone company, Dayton, O.
H. B. Pruden, Home Telephone company, Dayton, O.
W. W. Watson, T. and M. Telephone company, Barry, Ill.
M. L. Stauffer, T. and M. Telephone company, Barry, Ill.
Claude R. Stopps, Napanee Telephone exchange, Napanee, Ind.
H. T. Manner, Farmers' Co-operative Telephone company, Mansfield, O.
Edward J. Hall, Wilhelm Telephone company, Buffalo, N. Y.
H. A. Price, Valley Telephone company, Saginaw and Bay City, Mich.
G. H. Cowdery, secretary (Geneva, O.) Ottumwa Telephone company, Ottumwa, Ia.
W. H. Butler, Ravenna Home Telephone company and Kent Home Telephone company, Ravenna, O.
J. B. Ware, secretary Citizens' Telephone company, Grand Rapids, Mich.
Frank L. Beam, president Mount Vernon Telephone company, Mount Vernon, O., and vice-president of Millersburg, Wooster and Orrville Telephone company.
D. E. Sapp, Mount Vernon Telephone company, Mount Vernon, O., and Millersburg, Wooster and Orrville Telephone company.
George W. Finch, Finch Telephone company, Escanaba, Mich.
James B. Hogg, secretary Theris Telephone company, Cleveland, and vice-president Youngstown Telephone company, Youngstown, O., Black River Telephone company, Lorain, O., and Cuyahoga Telephone company, Cleveland, O.
F. W. Grudolph, Oak Harbor Telephone exchange, Oak Harbor, O.
James W. Sale, general manager United Telephone company, Bluffton, Ind.
L. C. Davenport, treasurer United Telephone company, Bluffton, Ind.
O. Rex, North Manchester Telephone company, North Manchester, Ind.
John M. Cortrum, North Manchester Telephone company, North Manchester, Ind.
R. F. Blount, Home Telephone company, Wabash, Ind.
Wilder Kendall, Home Telephone company, Wabash, Ind.
H. W. Koohler, People's Telephone company, Leavenworth, Kan.
Carl Seyler, McIntosh-Huntington company, Cleveland, O.
E. T. Munger, president Havana Telephone company, Havana, Ill.
Ira Cadwallader, West Lebanon, Ind.
Rossville Telephone company, Marshfield, Ind.
Perry M. Warner, Rossville Telephone company, Rossville, Ill.
M. T. Lott, Elmwood Telephone company, Elmwood, Ill.
L. C. Young, Campbellstown and Eaton Telephone line, Campbellstown, O.
Frank B. Pinney, Portsmouth, O.
E. H. Martin, E. H. Martin Telephone company, Webster City, Ia.
W. P. Patterson, Mutual Telephone company, Fort Scott, Kan.
J. A. Miller, Mount Sterling, O.
C. E. Pickert, Moberly Telephone company, Moberly, Mo.
Will K. McCray, Home Telephone exchange, Kentland, Ind.
George N. Bandy, president Iowa Telephone association and president Hawkeye Telephone company, Perry, Ia.
Charles C. Deering, secretary Boone County Telephone company, Boone, Ia.
Hiley H. Oustott, Du Quoin, Ill., McLeansboro Telephone company, Youngblood and Stamper, Burton, Ill., and Du Quoin Telephone company.
G. F. Briggs, Chicago Telephone Supply company.
William Hoyle, Cambridge Home Telephone company, Cambridge, O.
P. G. Farraw, Paris, Ill.
George W. Hughes, Hume, Ill.
F. Knickerbocker, Danville, Ill.
W. W. Toby, Danville, Ill.
E. E. Bonticoti, Danville, Ill.
T. L. Springer, Greenfield, Ind.
C. W. Shimel, Shimel Telephone company, Casey, Ill.
F. B. Patten, Sandwich, Ill.
W. H. Spreer, Marseilles, Ill.
G. M. Stevenson, Bellefontaine, O.
C. R. Post, Chagrin Falls, O.
S. W. Towle, Clinton, Ia.
J. C. Joslyn, Sycamore, Ill.
E. Rogers, Sycamore, Ill.
F. E. Harvey, White Hall, Ill.
Evan Shelby, La Fayette Telephone company, La Fayette, Ind.
A. R. Markle, Brazil Telephone Construction company, Brazil, Ind.
Robert Ross, Eagle Creek, Tenn.
C. E. Guilford, Kenton Telephone company, Kenton, O.
F. E. Graves, Northern Illinois Telephone company, Hinckley, Ill.
William Lohmiller, La Crosse Telephone company, La Crosse, Wis.
L. D. Fitcher, president Lee County Telephone company, Dixon, Ill.
George H. Greene, Lee County Telephone company, Dixon, Ill.
E. A. Croll, general manager Menominee Range Telephone company, Iron Mountain, Mich.
Edward L. Barber, Northwestern Ohio Telephone company, Wauseon, O.
C. B. Talmon, president Beloit (Wis.) Telephone company.
E. F. Brown, president Menominee Range Telephone company, Iron Mountain, Mich.
W. Van Middlesworth, People's Telephone company, Racine, Wis.
Allen Shewman, People's Telephone company, Racine, Wis.
Edwin A. Knapp, Clinton County Telephone company, Carlyle, Ill.
Edward Samson, president Jackson Union Telephone, Anna, Ill.
Carlyle B. Miller, Tri-city Telephone company, Clinton, Ia.
W. Forman Collins, Western Electrician, Chicago.
L. M. Jennings, Marseilles, Ill.
E. P. McConnell, manager United Telegraph, Telephone and Electric company, Chicago.
John W. Sale, Home Telephone and Telegraph company, Fort Wayne, Ind.
William L. Moelling, secretary Home Telephone and Telegraph company, Fort Wayne, Ind.
William A. Wright, manager Hillsboro Telephone company, Hillsboro, Ind.
Charles E. Brown, secretary Central Electric company, Chicago.
F. M. Pierce, Central Electric company, Chicago.
John B. O'Hara, Western Electrician, Chicago.
Charles L. Jeffrey, president Western Indiana Telephone company, Chesterton, Ind.
John A. Stephens, Western Indiana Telephone company, Chesterton, Ind.
Robert Felton, Western Indiana Telephone company, Chesterton, Ind.
A. D. Pyke, Tippecanoe Telephone company, Romney, Ind.
Henry Shobe, Tippecanoe Telephone company, Kirkpatrick, Ind.
M. P. Gladden, Tippecanoe Telephone company, Stockwell, Ind.
J. C. Harper, Dane County Telephone company, Madison, Wis.
H. O. Ragh, Ottumwa Telephone company, Ottumwa, Ia.
A. J. Vernier, Fayette and Archbold Telephone company, Archbold, O.
E. J. Pietzcker, American Steel and Wire company, Chicago.
W. S. Weiant, Newark Telephone company, Newark, O.
T. F. Ahern, Detroit, Mich., Detroit Telephone company, New State Telephone company, Michigan, and People's Telephone company, New Orleans, La.
H. J. Kusel, Eureka Electric company, Chicago.
John D. Pugh, Mutual Telephone company, Shelbyville, Ind.
Daniel Deprez, Mutual Telephone company, Shelbyville, Ind.
J. R. Wiley, Standard Underground Cable company, Chicago.
A. T. Presson, president Interstate Telegraph and Telephone company, Hudson, Wis.
E. C. Lane, De Kalb County Telephone company, Genoa, Ill.
K. Y. Murray, assistant superintendent United States Telephone company, Cleveland, O.
A. L. Munsell, Atchison, Kan.
F. F. Sapp, Southern Telephone company, Nashville, Tenn.
A. B. Miner, secretary Marquette County Telephone company, Ishpeming, Mich.
George A. Dole, Owensboro-Harrison Telephone company, Owensboro, Ky.
William Everly, superintendent Plymouth Telephone company, Plymouth, Ind.
F. A. Churchill, Jr., president United States Telephone Manufacturing company, St. Louis.
H. C. China, Lewis County Telephone company, Canton, Mo.
Dr. A. J. Horlelly, manager Elkhart County Telephone company, Shipshewana, Ind.
Perry J. Freeman, president Richmond Home Telephone company, Richmond, Ind.
C. C. China, Missouri and Illinois Telephone company, Canton, Mo.
Nathaniel Heinemann, president Wausau Telephone company, Wausau, Wis.
W. W. Albers, treasurer Wausau Telephone company, Wausau, Wis.
G. D. Jones, director Wausau Telephone company, Wausau, Wis.
C. F. Bennett, Cedar Valley Telephone company, Waterloo, Ia.
G. Bicknell, Cedar Valley Telephone company, Waterloo, Ia.
Mack F. Hosen, Columbus, Ind.
W. H. G. Butler, Citizens' Telephone company, Columbus, Ind.
J. M. Thompson, Columbus, Ind.
W. E. Moss, secretary Evansville Telephone company, Evansville, Ind.
F. H. Pollock, Plattsmouth Telephone company, Plattsmouth, Neb.
F. H. Ewing, electrician, Plattsmouth Telephone company, Plattsmouth, Neb.
A. Stromberg, Stromberg-Carlson Telephone Manufacturing company, Chicago.
L. G. Bowman, Stromberg-Carlson Telephone Manufacturing company, Chicago.
W. H. Carter, manager Sans Souci Park, Chicago.
F. P. Cook, Sterling Electric company, Chicago.
J. F. Tompkins, Sterling Electric company, Chicago.
B. B. Downs, Electric Appliance company, Chicago.
S. A. Rall, Electric Appliance company, Chicago.
W. P. Upham, Electric Appliance company, Chicago.
J. A. Williams, Williams Electric company, Cleveland, O.
Burt Hubbell, Williams Electric company, Cleveland, O.
C. L. Burlingham, McDermid Manufacturing company, Chicago.
F. W. Burlingham, McDermid Manufacturing company, Chicago.
J. J. Kusel, Eureka Electric company, Chicago.
C. P. Platt, American Electric Telephone company, Chicago.
J. J. Speed, American Electric Telephone company, Chicago.
W. L. Dolman, American Electric Telephone company, Chicago.
C. W. Cobb, Central Electric company.
J. H. McGill, Northwestern Indiana Telephone company, Valparaiso, Ind.
Roy L. Pierce, Northwestern Indiana Telephone company, Valparaiso, Ind.
Dewey Newman, Illinois Electric company, Chicago.
L. K. Cushing, Illinois Electric company, Chicago.
G. A. Briggs, Chicago Telephone Supply company.

James S. Cuming, Central Telephone and Electric company, St. Louis, Mo.
A. W. Guest, Ogle County Telephone company, Rochelle, Ill.
W. E. Serviss, Greenville Telephone exchange, Greenville, Mich.
Otto Wettstein, Jr., La Porte City, Ia.
J. A. Russell, National Automotic Telephone company, Chicago.
C. O. Hatch, National Automatic Telephone company, Chicago.
J. K. Norstrom, National Automatic Telephone company, Chicago.
F. A. Lundquist, National Automatic Telephone company, Chicago.
B. M. Malone, Beloit, Wis.
J. B. Drilley, Hebron, Ind.
John McGregor, Madison, Ind.
F. R. Strickler, president Franklin Telephone company, Franklin, Ind.
W. F. Marshall, Northwest Missouri Telephone company, Tarkio, Mo.
N. V. Perry, president Perry Electric company, Peoria, Ill.
Marcellus L. Joslyn, president Citizens' Telephone company, Woodstock, Ill.
Clarence N. Goodwin, manager, Citizens' Telephone company, Woodstock, Ill.
G. B. Chorpening, Clarkesburg, W. Va.
F. R. Strickler, Franklin, Ind.
John McGregor, Madison, Ind.
F. H. Schminler, Marion, Ia.
Fred Bishop, Central City, Ia.
A. H. Ramsey, Crawford, Ind.
Don Singleton, Clinton, Ky.
A. D. Hill, Whiteside-Harrison Telephone company, Morristown, Ill.
Ira B. Hyde, Princeton, Mo.
H. G. Orton, Princeton, Mo.
A. L. Millard, Citizens' Telephone company, Terre Haute, Ind.
G. S. Van Deusen, Merchants' Mutual Telephone company, Michigan City, Ind.
L. E. Milry, Napoleon Telephone company, Napoleon, O.
William Folchemer, La Fayette Telephone company, La Fayette, Ind.

Entertainment Features.

Among the general arrangements for the entertainment of delegates and visitors at the convention the expedition to Sans Souci under the guidance of Messrs. Doolittle and Cook of the Sterling company, on Tuesday evening, is worthy of special attention. A special train on the Alley L road was secured, and the telephone men taken from Congress street to the South Side pleasure ground. The visitors enjoyed the several features of the entertainment, especially the electric fountain, and then paid a visit to the Spanish dance hall, where a special entertainment had been prepared. During the evening the members of the party enjoyed the hospitality of the Sterling company, and they expressed their appreciation of the courtesies extended by a vote of thanks.

On Wednesday afternoon the delegates were given a tally-ho ride, through the courtesy of the manufacturers and supply men, through the South Side parks of Chicago. The procession left the Auditorium about three o'clock and went down Michigan avenue, thence to Grand boulevard, through Washington Park, and by the way of the Midway through Jackson Park, where a steamer was in readiness to take the delegates back to the city. It was to be regretted that the weather was not as auspicious as it might have been and that the visitors were not able to see in sunshine the full beauties of Chicago's parks. Notwithstanding the weather, however, a very pleasant afternoon was spent.

The banquet Wednesday evening was a most enjoyable affair. The banquet hall of the Auditorium had been appropriately decorated for the occasion and the tables were arranged in a very attractive manner. About 300 guests participated in the evening's festivities. Mr. Hugh Dougherty discharged the duties of toastmaster in a very acceptable manner. The responses were uniformly good and were fully appreciated. The convention closed with the banquet. It was a fitting ending for such an important and successful meeting.

Illinois Telephone Association.

One result of the meeting of telephone men in Chicago last week was the reorganization of the Illinois Telephone association. On Tuesday afternoon the Illinois delegation had a meeting at the Auditorium and determined to continue the state organization, and make it a much more efficient body than heretofore. Eight new members were secured at the meeting, and assurances were given that others would be brought in.

The following-named officers and committeemen were chosen for the ensuing year: President, Dr. I. A. Lumpkin, Mattoon; vice-president, J. C. Joslyn, Sycamore; secretary, E. P. McConnell, Chicago; treasurer, Hiley Hiram Oustott, Du Quoin; arbitration committee, G. W. Hughes, Hume; E. R. Conklin, Lockport; L. D. Pitcher, Dixon; executive committee, Dr. I. A. Lumpkin, Mattoon; P. G. Farrow, Paris; E. M. Harwood, Shelbyville.

The association will be represented in the national organization by J. S. McConnell of the United Telegraph, Telephone and Electric company of Chicago, which has an exchange in Hyde Park.

TELEPHONY ABROAD.

Stockholm is generally considered the city of telephones. It has 23,000 telephones to less than 300,000 inhabitants, according to a recent estimate. Paris has only 17,000, to 3,000,000 people. Stockholm and Paris are also said to be the only cities in the world that have a complete double-wire system.

Essentials of Telephone Construction.[1]

By Maxime Reber.

When an analysis is made of the numerous elements which enter into telephone construction, and the functions of each are properly weighed and considered, it becomes very difficult to separate what is essential from that which is of secondary importance. Local conditions are of such importance that methods particularly suitable in one case might be altogether unfitted for another.

A peculiarity of telephonic speech transmission is that, under favorable circumstances, surprisingly good results can be obtained with very inferior apparatus and construction, while to secure a service that will at all times be accurate, rapid, reliable and satisfactory requires most careful methods and the best of workmanship and materials, and no detail is too insignificant to receive thoughtful consideration.

To cover all the points which merit careful consideration in building a complete telephone exchange would require the setting forth of complete specifications and full instructions, covering every class, feature and detail of the work, together with numerous drawings, diagrams and charts.

The literature on modern telephone apparatus and methods is very meager, and the members of this association and of the several state organizations should prepare and read at such meetings as this convention extended papers on subways, pole-line construction, wire and cable manufacture and installation, interior wiring, switchboard systems, telephone instruments, batteries, protective devices, organization, cost of materials and work, and other collateral subjects. The need of such information is evidenced when the construction of many telephone systems is examined, as in many instances a proper knowledge of the subjects would have prevented much inferior construction and the improper use of much good material.

The subject of telephone construction is of such magnitude and diversity that a paper of this character must, necessarily, be unsatisfactory, in that only an outline of what should be done can be set forth, without attempting to describe how results can be achieved.

The ideal telephone system is that in which speech is clearly and accurately reproduced, in pitch, volume and quality, in which subscribers can communicate with one another with the least exertion on the part of the subscriber, and in the minimum amount of time, and which is free of extraneous noise, and always is in working condition, and these conditions should be as closely approximated as possible in actual practice.

A very important consideration before construction is started is the line capacity for which the exchange should be built. In determining what this capacity should be a careful study of the local situation should be made, and, if possible, a thorough canvass for subscribers should be made before the construction is started.

Ample provision should be made for future growth, and in making such provision estimate should be made of the ultimate capacity to which the exchange may grow. The system should then be laid out in such manner that the growth to such ultimate capacity can be made from time to time to the construction originally put in; and when the ultimate capacity is reached the exchange will be a harmonious whole. Many exchanges which have been built in the past, because proper provision for growth had not been made when the exchange was first built, have had to be completely reconstructed in the course of a few years.

The system of distribution should next receive consideration, in order to determine whether it is more economical and satisfactory to furnish all the service from one central exchange, or from a central exchange with sub-stations. This problem requires a separate solution for each city, and is one into which many elements enter. In some cases it will be found more advantageous to use the single central-exchange system, while in others the central-exchange and sub-station system is preferable.

A complete distribution must be worked out for both systems before the problem can properly be solved, considering the cost of subways, cables, including the interconnecting trunks between substations and the central exchange, rent, light, heat, operators' payroll, switchboard attendants, interest on first cost and rapidity, accuracy and reliability of service. The solution of this problem requires much time, care and accurate calculation, but it merits and should receive such attention.

As much subway should be built as the money available will permit, for when the wires are once placed in subway they require but small attention, give little future trouble, and the maintenance expense is small. They are guarded against injury from wind, sleet, fire and crosses with high-tension wires, and are free from inductive disturbances. The subway system should be built with a generous duct capacity, sufficient for the ultimate number of lines which will be supplied at the central station from which the subway starts. The subway should be laid to such grades that there will be no low points or traps in the conduit which will not drain into the manholes.

The manholes should be built of as large size as possible. Manholes are never built too large, and in no case should they be smaller in length in the direction of the subway than four feet, and should have a width of the same dimensions as the length, although width can be better sacrificed than length. The conduit should be laid in an encasement of concrete, except under particularly favorable conditions. Manholes should be built of hard-burned brick, laid in Portland-cement mortar, to be plastered on the outside to make them watertight, and as the brickwork is laid up the ironwork for cable supports should be built in, together with the laterals and ventilating pipes. Ventilation should always be provided, to prevent the accumulation of dangerous or explosive gases. Covers of manholes should be substantial castings, sufficiently heavy to carry any load that might be drawn over them. As the work progresses, records of distances between manholes and the dimensions of manholes should be made, so that there may be no delay in furnishing this data to the cable manufacturer. Orders for cables should be placed as soon after subway has been constructed as possible.

Poles should be of good, sound, durable timber, and should be set vertically and so that the tops will line up in a straight line. The diameter of poles at tops and butts will vary with the kind of timber to be used, but poles of any kind should not have a smaller diameter at the top than seven inches. Heavy poles should be selected for corners and terminals, and such poles should be given a little additional depth in setting. The poles should be thoroughly guyed, and for city work poles should be set on an average not farther apart than 125 feet, and should be shaved, painted and provided with pole steps. Long spans and terminal spans should be head-guyed. Poles shorter in length than 40 feet should be set to a depth of about one-sixth of their length, but long poles do not require a proportionately deep setting. In setting poles gains should be so faced that the cross-arms on alternate spans will face one another. In refilling the earth around poles, heavy tampers should be used, and the ground be thoroughly compacted. In wet and treacherous ground, or at corners, where guys cannot be secured, poles should be set in concrete.

Cross-arms on pole lines should be 10-pin cross-arms, preferably of long-leafed southern pine, and should not be smaller in size than 3¼ by 4¼, and should receive two good coats of paint. Cross-arms should be attached to the poles by bolts passing clear through the poles, rather than to be fastened to the poles by lag-screws. If wooden pins are used, they should be of locust, and should be fastened in the arm by nails driven through the shank of the pin, but steel pins are preferable.

All shims, rods, bolts, braces and other pole irons should be of good bar iron, heavily galvanized. The galvanizing should stand the usual immersion test in a saturated solution of sulphate of copper.

Pole lines should be laid out in alleys where possible.

Satisfactory and efficient service can only be furnished by having all the lines full-metallic construction. Grounded lines or common-return lines are objectionable, on account of cross-talk and noises from inductive disturbances. Such disturbances can only be effectually guarded against by having both sides of the circuit equally balanced and equally subjected to the same disturbing influence, which can only be done by full-metallic construction. Much more satisfactory long-distance service can be furnished to subscribers having full-metallic circuits, as no repeating coils are necessary, but connections to the toll lines can be made direct. Common-return lines and grounded lines require the use of repeating coils, in connecting up to subscribers having full-metallic circuits, or to toll lines, and these coils introduce a choking effect on the voice current.

The cost of full-metallic construction is, of course, greater than for grounded lines, but the difference in the character of service that can be furnished will generally compensate for the additional expense. Copper wire should be used for all lines, on account of its light weight and consequent decreased load on the pole lines, small resistance and capacity. Copper wire should be hard drawn, and should have a conductivity of not less than 97 per cent., and should conform to the usual requirements for elongation, tensile strength and twists. Joints on copper lines should be made with McIntyre or similar sleeves, and the use of soldering irons should not be permitted on hard-drawn copper.

In stringing wire, the wire should be given such a sag, depending upon the temperature at the time of stringing, that in very cold weather the lines will not be drawn up too tight. In case the expense of copper is prohibitory, then iron lines may be used for local distribution and for short toll lines, but such iron should be of good quality, with a low ohmic resistance, and be well galvanized.

Gases and fumes from manufacturing establishments in cities attack iron wire much more readily than copper, and iron wires have a correspondingly short life, and the corrosion of iron wires adds to their resistance. Iron wire is objectionable in long toll lines, on account of its weight, large ohmic resistance and the retarding effect on speech transmission of its magnetic properties.

A large use of aerial cable is to be recommended, for the reason that such cable requires small space on the pole lines, and on account of its construction is free from inductive troubles. Multiplicity of open wires is objectionable, on account of their

1. Read before the Independent Telephone association, Chicago, June 27, 1899.

unsightly appearance, the liability to break down from the accumulation of snow, sleet and wind loads, the additional length of pole required, the liability of crosses with high-tension wires, the difficulty in transposing to neutralizing inductive disturbances, and the obstructions offered to firemen.

The suspension of aerial cables should be carefully done, and be made strong and secure with a large factor of safety. Great care should be exercised in testing cables at the place of manufacture, and accurate records of these tests should be preserved. Joints should be very carefully made, and none but experienced men should be permitted to make the splices. Cables should begin and end at terminal heads, so that testing and repair work can readily be done. Careful records should be made of the insulation resistance, specific inductive capacity and ohmic resistance immediately after the cables have been erected, for comparison with subsequent tests to determine if any deterioration has taken place. Such data will be found very convenient in locating faults. Telephone cables made up of wires served with a double wrapping of paper, the separate wires twisted in pairs, the whole formed into a core with reversals, and encased in a lead sheath, as provided for in the conference specifications, will insure good cables. Cable hangers which will securely fit the cable without injury to the sheath should be used, and the spacing of these hangers should be uniform on the cable, and close enough together to prevent appreciable sag between the points of suspension. Cables should be carried on pole lines at as low point as will clear obstructions and conform to ordinances governing the stringing of wires. Substantial platforms should be securely attached to the poles at every cable terminal.

Rubber-covered wire should be used in wiring up buildings and the wiring should be concealed as much as possible. Telephones should be placed only on solid walls, where they will not be affected by vibration, where they are readily accessible and will not impede any passageway. In noisy places, or where privacy is required, sound-proof cabinets should be used. Ground wires, whether for lightning discharge or for use in a signaling circuit, should be attached to water pipes, gas pipes, between the meter and the main, or to ground wires driven to moist earth. Bright metallic contacts between the ground wires and ground rods should be made before the soldering is done, and the joints should be securely made. The wiring, in all cases, should conform to the requirements of the National Electrical Code. The lightning and sneak-current protection should be so placed that no dangerous currents can enter the building.

Selection of switchboard should receive much intelligent care and consideration, as it is largely upon the workings of the switchboard that the character of the service depends. The very best of workmanship and materials is none too good, and the design should be as simple as possible, eliminating as far as may be the use of relays, condensers, repeating coils and other secondary apparatus. That system which requires the fewest number of movements to be made by the switchboard operator to place two subscribers in communication is the best, both on account of the rapidity of service which can be furnished and the reduction of possible mistakes on the part of the operator to a minimum. Where an exchange is to begin with more than 800 subscribers, it will be found more advantageous to use a multiple switchboard, rather than one requiring a trunking system between the operators. Supervisory signals should always be provided, which indicate to the operator if the party called for responds, and when subscribers have finished their conversation.

The switchboard should be so built that additions can be made to the ultimate capacity to which the exchange will grow, without interference with any of the wiring first put in, and the distributing boards and cross-connecting boards should be erected with like provision. A complete monitor and test system should be provided, and ample provision for connecting to the tollboard, which should be put in at the same time and be wired up in connection with the main switchboard. The storage-battery and motor-generator equipment should be in duplicate. The failure to make ample provision in this respect results in frequent and vexatious interruptions to the service.

After having considered all of the electrical and mechanical features of the switchboard, and before a decision is arrived at, an opinion should be obtained from some competent patent attorney, stating that the switchboard does not infringe any good and valid patents. A vast number of patents relating to telephone apparatus and circuits has been issued, and an authoritative opinion on the validity of the patents can be pronounced only by one who makes a special study of such matters.

The exchange should be located at the center of distribution, so that the number of feet of wire required to reach all subscribers is a minimum, provided available quarters can be secured in the locality meeting this requirement, and the rent is not prohibitory.

The switchboard room should be light, well ventilated and easily warmed, and readily accessible. Sufficient space should be provided in the switchboard room for growth of the system, as it is very expensive and unsatisfactory to be compelled to change the location of the central exchange, and this is more especially so where subway is used.

Lockers, luncheon and retiring rooms should be provided for the operators, and these rooms should be bright and attractive.

The telephone instruments should be of neat and attractive appearance, with well finished woodwork and with all exposed metal parts heavily nickeled. They should be made so as to occupy as small space on the walls as possible. Bipolar receivers and granular carbon microphones will generally give more satisfactory service than other types.

Wiring of the telephones should be well done, and all joints should be soldered and all contacts so designed that oxidation or the accumulation of dust cannot introduce resistance into the circuits. The automatic switches should be of the long-lever gravity type. All magnet wire should be of the best quality copper wire, covered with a hard, close winding of silk. The calling device should be positive and reliable in its operation, and that device which will require the least exertion on the part of the subscriber to call the central exchange is the most desirable. In any event, the clearing-out signal should be automatically operated by replacing the receiver on the hook. Experience has shown that many of the subscribers will not ring off when conversation is finished, and unless an automatic device is used, the operators will have to listen in constantly to ascertain if the lines are in use. This requires more operators to take care of a given number of lines than with an automatic clearing-out signal, and unless the operators constantly watch the lines, they will test busy, or appear to be in service, when not actually in use.

Special magnet steel should be used for all permanent magnets, as much annoyance and poor service is traceable to the use of cheap and inferior magnet steel. Receivers should preferably be made so that they cannot get out of adjustment, and when this is not done, provision should be made for rapidly and accurately making the adjustment.

Receivers and the mouthpiece of transmitters should be of the best quality of hard rubber. The iron, brass, german silver, hard rubber, wire, cables and all other parts used in the manufacture of telephones and switchboards should be of the very best quality, and should be particularly suitable for the purpose for which they are to be used.

Batteries to be used with subscribers' telephones should be of the best grade open-circuit batteries, with a low internal resistance, quick recuperative power, large amperage on short-circuit, and with a high voltage. On very busy lines closed-circuit batteries should be used.

Each subscriber's line and each line as it enters into the central exchange should be protected with some device which will effectually bar the entrance into the buildings or the switchboard of destructive currents, and secure immunity to persons and property from lightning discharges, or the crossing of telephone wires with wires carrying currents of high voltage. As a rule, protection can best be obtained by a suitable combination of heating coils and carbon plates, so arranged that sneak currents will operate upon the heating coils and ground the line wires, which should be provided with fuses outside of the building that will blow with a current of not to exceed four amperes.

Detailed instructions should be prepared, covering every class of work, and these instructions should be full, clear and precise, and the work should be supervised with sufficient care to see that it is performed as set forth in the instructions. Specifications should be written, covering every class of material which is used, which should be sufficiently detailed to cover every essential point, and inspection should be made to see that these requirements are fulfilled. It will generally be found that money paid for inspection is most judiciously expended.

In the past there has been much inferior work done and apparatus manufactured, and while there may have been some excuse on account of the inability of independent manufacturers and exchange builders to secure proper materials and experienced workmen, there is at this time no reason for turning out any but high-grade work in every branch. Manufacturers have now had sufficient experience to understand what is necessary, should have properly equipped shops, can now purchase high-grade materials, and secure mechanics skilled in the manufacture and assembling of telephone and switchboard parts.

It will usually be found advantageous to purchase complete switchboard and telephone instruments in preference to purchasing parts and each telephone company assembling its own apparatus. The established manufacturers have special facilities and trained men, and can turn out better work at as low a price as it will cost to do inferior work.

As in all other construction careful preliminary studies and estimates should be made. The work should be divided into different departments with a capable and responsible man in charge of each. Rate of progress should be established so that work of different departments will all be completed at about the same time.

Materials should be purchased on competitive bids, based on detailed specifications, and should be critically inspected before being used. When quantities are large enough to warrant traveling expense, inspection at the point of manufacture will be found advantageous.

In general, essentials of good telephone service are reliability, accuracy and rapidity. Reliability can only be secured by placing all parts of the equipment as far as possible out of the reach of disturbing causes, and this is best done by a comprehensive subway system and an aerial cable system of distribution, with concealed wiring in buildings where telephones are located.

Rapidity and accuracy can best be secured by use of automatic devices of tested merit, to as large an extent as possible, and by having a minimum number of contracts to be made before connection between two subscribers is effected.

Mistakes made in the past should prevent like recurrences in the future. The experience gained by the pioneers in the independent movement and the Bell companies should be thoroughly considered; features of proved merit should be adopted and faulty construction should be avoided.

Michigan Lines.

[From the Detroit correspondent of the Western Electrician.]

The New State Telephone company will install an exchange at Belleville, Mich.

The Common Council of Niles has granted permission to the Twin City Telephone company for an exchange there.

The linemen of the Michigan Telephone company are again out. This time it is a question of wages. The men demand $60 a month, instead of $55. There are about 200 linemen involved. Warning has been given the company that unless the matter is straightened out by the next pay-day there will be serious trouble.

John T. Belanger of Detroit has just had patented a telephone-toll apparatus.

The Michigan Telephone company is acquiring right-of-way near Holly. The present state law is such that the company cannot trim trees for wires without the consent of the farmers, and the new scheme is, therefore, to run the lines along the railroad tracks, three feet from the fences, and pay the farmers a small sum for the right-of-way. The company contemplates moving all wires to leased property as soon as the new service is ready.

At the annual meeting of the Michigan Telephone company, the one-minute system of charges was adopted. Heretofore, if a man talked four minutes, long distance, he was charged for five, and if he talked six minutes he had to pay for 10. The toll from Detroit to Kalamazoo has, heretofore, been $1.25 for five minutes' talk; hereafter it will be 21 cents for a minute.

It will be impossible to lay the cable between Mackinaw and St. Ignace the coming season, but the whole northern country system will be in connection with the southern peninsula by the end of the year. The maximum rate to Mackinaw will probably be about 50 cents.

The first one-minute toll circuit to be opened will be Detroit to Kalamazoo; after that, Kalamazoo to Grand Rapids.

The one-minute toll system will doubtless cut into the revenues of the telegraph companies and may possibly precipitate the long-expected war between the Bell people and the Western Union.

The stockholders at the meeting approved of the construction of 3,000 miles of pole wire and 20,000 miles of long-distance wire, now under way. The treasurer's report showed a net gain of 6,088 subscribers since January 1st.

The new relay switchboard for the Detroit exchange will be equipped with an immediate capacity of 12,000. There are now 10 buildings in course of construction which will be used for exchange purposes.

The new board of directors comprises Charles J. Glidden, Lowell, Mass.; James P. McKinstry, Cleveland, Ohio; F. A. Forbes, Detroit; Thomas Sherwin, Boston; Hugh McMillan, Detroit; Robert T. Lincoln, Chicago; W. A. Jackson, Chicago. The new officers are: President, Charles J. Glidden; vice-president, J. P. McKinstry; general manager, F. A. Forbes; local treasurer, Hugh McMillan; secretary, George B. Berham; treasurer, Chas. A. Grant.

MANUFACTURERS AND DEALERS.

The American Hardwood Manufacturing company, Grottoes, Va., which manufactures all kinds of telephone woodwork, reports a large increase in orders. It has found it necessary to place additional machinery in its works and largely to increase its force of employes to keep up with its trade.

President James E. Keelyn of the Western Telephone Construction company of Chicago reports that his company is now doing a larger business than at any previous time in the history of the company. The many improvements that are being made in Western telephones, the new patents that the company is taking out, together with the new high-grade machinery that is being added to the company's already well-equipped factory, furnish unmistakable evidence of the stability of the company, and is assurance that it is determined to be the leading manufacturer of telephone apparatus in the United States.

The Engineering and Mining Journal thinks that the substitution of aluminum for copper for electrical work to any great extent is not probable, or indeed possible, because the supply of aluminum is not large enough.

General Meeting of the American Institute of Electrical Engineers in Boston.

[Special correspondence of the Western Electrician.]

Boston, June 28.—The opening session of the three days' meeting in this city of the American Institute of Electrical Engineers was called to order at 10:30 a. m. on Monday, June 26th, by the president, Dr. Arthur E. Kennelly of Philadelphia. By that hour about 50 members had assembled to participate in the proceedings, having registered their names and received badges in the headquarters of Secretary Ralph W. Pope of New York, who was installed in Room 14 of the Walker building at the Institute of Technology. For the actual work of the session one of the large lecture rooms of the Institute, on the second floor of the building, had been placed at the disposal of the members.

Mayor Quincy of Boston was present to extend a greeting from the municipality. Among other things, he said:

"The purposes of your organization appeal to me as having the greatest of interest for all who are concerned in the technical, industrial and financial progress of the country. I suppose it is impossible to find in industrial history an instance of development in which such large financial investment and such new life have been opened up as is afforded by the history of the department of electricity, not only in this country, but throughout the world, since the formation of your institution.

"That date seems to me to mark about the period when electrical development passed from the experimental or preliminary stage to the stage of an assured basis, and when it appeared to be a field for the very large investment of capital of the character which has taken place since 1884. The development and greater utilization of the telephone, arc light, incandescent light, electric street railway and electric motors for various purposes seem to me to afford a history of unprecedented advancement, and in the future those who study these things will, I think, look back on the last 15 years as one of the most interesting periods in the development of a new force, and in the applying of force to the service of man it is one which cannot be equalled in the records of the world.

"The possibility of converting the power of the steam engine to the transmission of electrical energy is probably the greatest discovery ever made. When we see the enormous factor which the telephone has been in the business and social life of the community, the influence of the electric light, and, most enormous of all, the extent of the electric railway, we realize, I think, that we have, to some extent, passed through an electrical revolution.

"While it is impossible to foretell what is in store for us at this period of the elementary discovery which has given us the telephone, electric light and street railway, I think we have by no means come to the end of the possibilities of electricity on the inventive more than we have on the industrial side.

"I believe the investment of capital in electricity will be even larger in the next 15 years than in the last 15, enormous as that has been.

"And, while a great deal of work in invention has been done, I believe there is a greater work yet to be done in furnishing and applying the apparatus of this great new force. It therefore seems a most excellent thing that the men who make a study of this subject from a strictly technical, scientific standpoint are organized in this institute.

"I am sure that your deliberations and the interchange of ideas and scientific knowledge cannot but be of benefit to the great study, and that the development of your ideas will have a very useful result for the many and varied interests now dependent upon the continued development of this great new force which has come into the industrial life of the world, and has led already to such a marvelous revolution in the actions and methods of mankind." (Applause.)

President Kennelly responded, and said that in view of the very able address of his honor, the mayor, he felt the great regret of the members was that his honor was not a member of their institute. He conveyed to Mayor Quincy the thanks of the Institute for his presence and his address, which showed that he evidently had an observant interest in electrical progress.

Secretary Pope then read a number of letters, most of them in the nature of invitations to visit various places of interest. These included an invitation from President Eliot and the fellows of Harvard College to have the members visit the various laboratories connected with the college. Similar invitations were received from President John C. Sanborn of the Boston Terminal company, to visit the station; from E. W. Rice, Jr., of the General Electric company, to visit the works at Lynn and Schenectady, N. Y.; C. R. Tenex, special agent of the American Bell Telephone company, offering free service over the lines to the members of the Institute; J. N. Keller, of the New England Telephone company, a similar favor, and an invitation to visit the company's exchanges; from President F. Tudor, Jr., of the New England Gas and Coke company, to visit the works in Everett; from Mayor Edgar R. Champlin of Cambridge, inviting the members to visit the manual training school and the pumping station; from General William A. Bancroft of the Boston Elevated Railroad company, to visit any of the company's power houses; from President F. A. Gilbert, of the Boston Electric Light company, to the works in South Boston; from the Technology Club, extending the use of its clubhouse, and from Elihu Thomson, to visit him on Wednesday evening at his residence in Swampscott, where informal "open house" would be kept for all. Regrets at inability to attend were sent by Gano S. Dunn.

The first business after these communications had been read was consideration of the important report of the committee on standardization, which was accepted as presented, without debate. [The report will be printed in full in a later issue of the Western Electrician.]

The first paper of the session was then submitted by Charles Proteus Steinmetz of Schenectady, N. Y. It was entitled "Symbolic Representation of General Alternating Waves and of Double-frequency Vector Products." A discussion followed, participated in by Louis Bell, Elihu Thomson, C. T. Hutchinson, W. E. Goldsborough, C. A. Adams, Jr., T. J. Johnston, H. J. Ryan and Samuel Sheldon.

Percival Robert Moses of New York presented a paper on "The Cost of Electricity in Some Typical Buildings in New York City." This provoked a warm discussion. Central-station service was championed earnestly by Arthur Williams of the Edison company of New York, and remarks were made by H. Ward Leonard, C. P. Steinmetz and H. B. Coho.

The next paper was by Professor Harris J. Ryan of Cornell University, on "Polyphase Electric Testing." The discussion that followed was participated in by Mr. Steinmetz, C. A. Adams, Jr., Samuel Sheldon and C. P. Matthews.

Only two papers were read at the second day's session of the association. There was a larger attendance when the hour of assembling arrived Tuesday than there had been on the preceding day, and the papers evoked some active discussions.

Allan V. Garratt of Boston was the first speaker, his general subject being the application of governing devices to water-wheel machinery. The address was illustrated, and commendatory comments followed from a number of the members. Among the participants in the discussion were C. F. Hopewell, W. S. Aldrich, C. W. Rice, C. P. Steinmetz, Louis Bell, W. E. Goldsborough, H. Ward Leonard and W. J. Hammer.

Cary T. Hutchinson of New York precipitated the most animated arguments of the convention with his paper on "The Protection of Secondary Circuits from Fire Risks" and the accompanying resolution. Most of the speakers favored the plan indorsed in the paper, and the resolution, after some slight changes in phraseology had been made, was adopted.

The discussion which ensued was mainly on the resolution. When the decisive vote was taken it stood as follows, a few changes having been accepted by Mr. Hutchinson:

Resolved, That this Institute favors a rule permitting the grounding of one wire of every low-tension consumption circuit; that the committee of the American Institute of Electrical Engineers on the National Electrical Code is hereby requested to confer with the electrical committee of the Underwriters' National Electric association in relation to recommending to the National Board of Fire Underwriters the passage of a rule permitting or requiring the permanent grounding of one wire of distributing systems under suitable restrictions; that they also confer with the same committee in regard to recommending to the National Board of Fire Underwriters some modification of rule 39 of the code in relation to the installation of secondary wires when the primary wires carry a current of over 3,500 volts potential.

In approving the paper, Elihu Thomson stated that fully 15 years ago he had come to the conclusion that a method of grounding, practically as outlined by the speaker, was the best way to deal with the difficulty. He had applied such a system to his former house in Lynn and found it practical.

C. M. Goddard of Boston seconded the resolution, and in his capacity of secretary and electrician of the Underwriters' National Electric association said the station manager and the underwriter were equally interested in a solution of the problem of eliminating risk. The underwriters were prepared to adopt whatever could be shown to be an efficient remedy for the evil.

W. E. Goldsborough did not consider it established absolutely that grounding was the best solution. Severe test of each equipment when installed should be insisted upon by the underwriters, who were not, in his opinion, sufficiently firm in their requirements.

Messrs. Steinmetz, Bell, James I. Ayer, Captain William Brophy of the Boston city wire department, W. L. Puffer and Calvin W. Rice all favored the resolution. Captain Brophy thought, however, that insulation ought to be looked after primarily. That was a preventive measure of primary importance. The greatest stumbling block of all, he believed, is the peculiar individual known as a contractor. Some contractors were reliable and ought to be appreciated at their true value, but there were others who ought to be in jail.

Dr. Bell said the condition under review exists all over the country, and the association ought to voice its sentiments on the subject in the interest of public welfare.

The vote on the resolutions was unanimous.

The closing session of the convention was held on Wednesday. Five papers were read, including two which were on the second day's schedule.

S. Everett Doane of Marlboro, Mass., was the first speaker. His paper was entitled "A Plea for a Working Standard of Light." Several members indorsed the idea of having a standard established. Professor W. E. Goldsborough offered this resolution, which was adopted:

Resolved, That a committee be appointed by the president to have in its care the furtherance of the establishing of a standard laboratory for testing lamps, instruments and materials, and that this committee look into the matter of standardizing incandescent lamps for the general profession, as the committee shall devise; that the committee make its report to the council of the Institute, with whom they shall advise, and that the council be authorized to promote the work financially, as they may deem best, to further the result to be attained.

The next paper was presented by Alton D. Adams of Boston, on "Motor-speed Regulation." Brief comments on the ideas contained in the paper followed, and the president next introduced John Price Jackson of State College, Pa., whose subject was "Electricity in Coal Mining."

Wednesday's programme proper was then carried out: "Air-gap and Core Distribution," by Professor W. E. Goldsborough of Lafayette, Ind; "Operating Costs of Horse and Electric-delivery Wagons in New York City," by George F. Sever and Robert A. Fliess of New York; "Electric Automobiles," by E. A. Sperry of Cleveland, O. These three papers were listened to with the closest attention, but discussion thereon was necessarily brief.

As a whole, the general meeting of 1899 was a great success. A feature was the several excursions to engineering points of interest on Monday and Tuesday afternoons. J. S. B.

Death of J. G. Moore.

John G. Moore, a New York financier and senior member of the stock-exchange firm of Moore & Schley, died on June 23d after a long illness. Mr. Moore was 52 years of age. For a number of years he was active in telegraph enterprises and he was a director of the Western Union company at the time of his death. In 1880, when the Western Union Telegraph company had apparently absorbed all its rivals, Mr. Moore and his partner, John O. Evans, conceived the idea of constructing lines connecting the principal cities and of leasing wires to bankers and merchants during their business hours and to newspapers at night. Abundant capital was readily secured, and the projectors soon had many leading points of the West and Northwest connected with the eastern cities, the competition thus established with the Western Union company resulting in a material reduction of telegraph rates. Finally, the Western Union bought the lines of the American Union Telegraph company, and then Mr. Moore organized the Mutual Union Telegraph company, which began energetically the task of constructing telegraph lines to all parts of the United States. Mr. Evans, as president of the company, attended to its finances, and Mr. Moore had charge of the work of construction and equipment. Before this work was completed Mr. Evans died, and Mr. Moore succeeded him as president. Soon thereafter the lines of his company were taken over by the Western Union Telegraph company under a 99-year lease, and Mr. Moore became a director of the latter corporation.

Trolley on State Street, Chicago.

Some time next week, probably, the Chicago City Railway company will abandon the use of the cable in State street for an indefinite period, and after that time trolley cars will be running in that street from the heart of the down-town district to Englewood. The engineers who have examined the cable station at Twenty-first and State streets have decided that the machinery is worn out, and will require a large expenditure to repair it. No statement is made as to when the repairs will be finished. The State street cable equipment was put in about 1881 and was one of the earliest plants of the kind in the country. Poles and wires for the State street line are now being placed in position where needed.

No doubt a similar course will be followed in the case of the Wabash avenue cable line. The Cottage Grove avenue portion of this line is supplied with power from the plant at Cottage Grove avenue and Fifty-fifth street.

Detroit Street-railway Ownership.

The question of submitting to a vote of the people a proposition to proceed to city ownership of the Detroit street railways was not decided last week. The special meeting of the Common Council called to consider the proposal resulted, after a parliamentary wrangle, in a reference of the questions involved to the committee on streets and ordinances. A resolution was offered calling a special election on July 10th. It was declared out of order by the president of the council, who submitted a legal opinion to the effect that the proposed special election is unauthorized by the city charter and would be illegal for various reasons. The resolution, together with the legal questions involved, was finally unanimously referred to the committee.

At a later date the pending ordinances and resolutions in reference to the proposed purchase were laid on the table by the Common Council. Thus the matter was indefinitely postponed.

A Lightboat for the Navy.

Among the improvements to be made on the U. S. S. San Francisco, now at the Norfolk navy yard, will be a new electric-light plant, 10 ammunition hoists, similar to those installed in the cruiser Newark at the navy yard last summer, and a change in the rig. The electric-light plant on the San Francisco will be placed in the tug Apache, which is to be converted into a lightboat and used in lighting vessels that are out of commission or that may be undergoing repairs.

Bullock Electric Manufacturing Company.

As an example of the advancement which is being made in the large manufacturing establishments of to-day, attention is called to the new manufacturing plant of the Bullock Electric Manufacturing company of Cincinnati, Ohio.

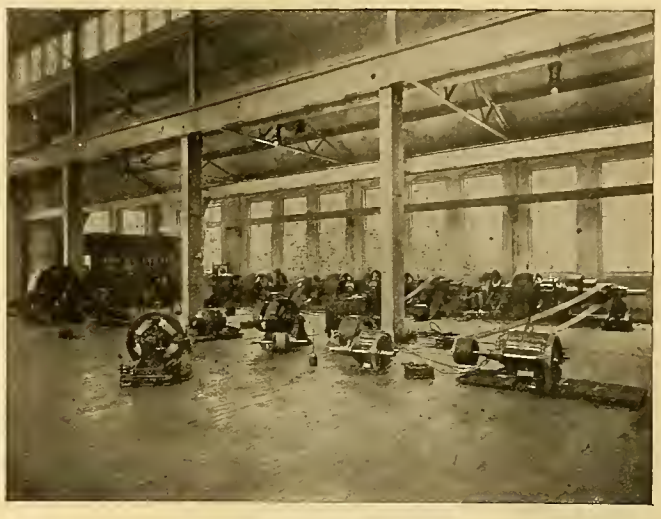
This model plant was completed last summer, and the company moved into it the first of the present year. The buildings are located at East Norwood, Ohio, one of the suburbs of Cincinnati, which is less than five miles from the heart of the city. The Baltimore and Ohio Southwestern railroad crosses the Pennsylvania lines at this point, and both roads have tracks entering the works, giving the Bullock company excellent shipping facilities.

Perhaps the first impression received by the visitor to the works is the simple yet beautiful architecture of the several buildings; second, the great tration of modern machine-shop methods could hardly be found. There are no long lines of shafting and counter-shafting; no unsightly and light-forbidding belts; each machine in the Bullock works is driven by an independent Bullock electric motor, which absorbs power from the transmission lines only when it is required, and, by reason of all this, one is deeply impressed with the improved atmosphere and absence of the noise due to constantly running belts and shafts. The application of independent electric motors for power purposes is here shown to be the ideal method.

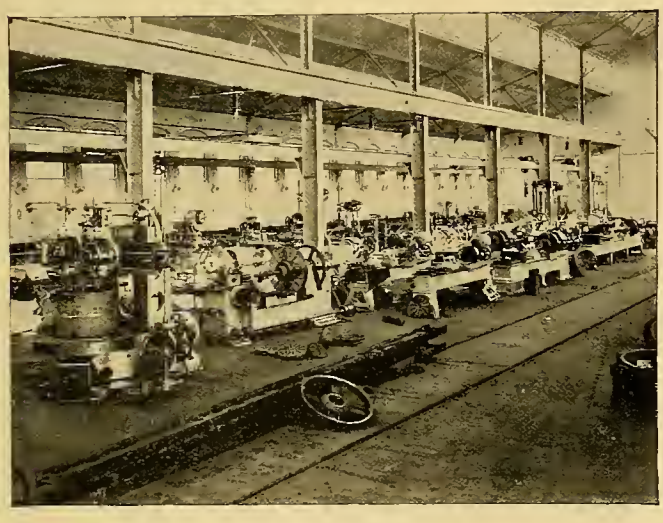
Among the machines equipped may be mentioned cranes, power presses, lathes, planers, drills, milling machines, profilers, emery grinders, hydraulic presses, boring mills, etc. The motors used for driving these various tools are designed and adapted for the tools mentioned, and are built into the head-stock of lathes, while in other tools they take the place of the driving pulley and require no more contemplating a change of power or material reconstruction of shops of any kind. Every machine employed is modern; every labor-saving and labor-facilitating device which could be profitably employed is there; every economic problem has been carefully worked out; and the result is a plant which is creditable in every way.

The officers of the Bullock Electric Manufacturing company are: President and treasurer, George Bullock; vice-president, J. S. Neave; secretary, James Wilson Bullock.

Administration Building.



Testing Department.



Machine Department.

Machine Shop.

BULLOCK ELECTRIC MANUFACTURING COMPANY.

amount of light and general cleanliness within. The buildings are constructed of light buff pressed brick, with appropriate trimmings of stone, and separated from each other by grass plots, flowers and shrubs.

The plant comprises the administration building, machine shops, foundry and power house.

In the administration building are the general offices, drafting and pattern rooms, lunch room for officers and heads of departments, with a completely equipped kitchen and pantry, general lavatory and locker rooms for workmen. In the main hall of the administration building is an office of the Postal Telegraph-cable company and a telephone exchange, with lines extending to the various departments of the works. The offices are provided with all modern conveniences, and finished in quartered oak, with partitions, doors and windows of stained and plate glass. The dressing-room section set apart for mechanics and shop employes is not only provided with the usual toilet arrangements for the men, which, by the way, are thoroughly modern in every detail, but there is also a complete system of lockers and baths. Each man has a locker under key placed at his disposal, and in the lavatory are set bowl, shower and needle baths.

The drafting and pattern rooms are on the second floor of the administration building and are very light and commodious. The kitchen and lunch room, also on this floor, are home-like in equipment and decoration.

The machine shops of the Bullock works are models, and illustrate the great economic progress made in manufacturing methods. A better illus-

room. The motors are of the Bullock slow-speed type, with the variable-speed control governed by the Bullock multiple-voltage system. The tools may be operated in six varying speeds in either direction, without the use of back gearing or any resistance whatever in the electrical circuits. The economies effected by application of motors to machine tools, although in first cost slightly more expensive than the use of line shafts, belting and counter-shafts, soon justifies the additional expenditure. The output of the tool is largely increased on account of the multiplicity of speed obtainable and the facilities for changing these speeds while the tool is in operation. Space is economized, as the tool may be located without reference to line shafting.

The power house is provided with vertical water-tube boilers, equipped with automatic stokers. A cross-compound engine direct-connected to two of the Bullock Electric Manufacturing company's engine-type generators supplies current not only for the lighting system, but for the company's multiple-voltage power-transmission system used throughout the entire plant. An elaborate switchboard has been erected with the necessary instruments and switches, including recording wattmeters registering the amount of power being used on the various circuits. A section of this building, occupying the whole southerly end, is set apart and fitted out for the employes' lunch room. Apparatus for heating the general machine shops is located in the basement of the power house, and hot air is conveyed underground to its destination.

Altogether the plant is a notable one, and one which is worthy of a visit from any manufacturer

The Wilmington Exhibition.

It is said that all the space for the Wilmington (Del.) Electrical Exhibition, in connection with the fourth annual convention of the National Association of Municipal Electricians, has been taken, and everything points to a most successful meeting. Delegates from the United States and Canada will be present, and it is expected that over 100 cities will be represented. The Board of Trade of the city of Wilmington has taken in hand the matter of entertaining members and guests of the association, and an enjoyable time is anticipated. The Pyle Cycle Academy will be at the disposal of exhibitors on and after August 28th. All exhibits must be in place not later than Monday noon, September 4th, as the exhibition opens at 7:30 p. m. on that date. H. B. Mason, 340 Fulton street, Brooklyn, N. Y., can give further information.

Mica Mining.

A recent writer in the Age of Steel says that the mining of mica is the poetry of mining. It is impossible to conceive of a more exciting and fascinating employment. The vein of mica-bearing quartz, lying between rocks of different formation, has been found. The cap rock has been blasted away. Little "niggerheads"—small lumps of crumbling mica mixed with slate and other rock—are growing plentiful. The rock is carefully examined by the experienced miner, and all indications are that mica will soon be found. A blast is made. The rock and debris are cleared away, and there in the bottom is a block of the precious stuff, a ragged corner showing itself black and glittering in the white quartz in which it is imbedded. With the tips of the fingers the miner gently and affectionately brushes away the dirt and small stones which partly cover it. Its thickness is carefully noted; its position in the rock is learnedly discussed, and many a speculation indulged in as to its size and quality. The hole is

quickly drilled; the small blast is made, just loosening the rock, and all eagerly crowd around as one of the men with his pick pulls away the broken stone. There it lies, a black glittering mass, nine or 10 inches across its face, three or four inches thick, and irregular in shape, as all blocks of mica are. A good-sized block, and, if solid and of perfect cleavage, will be worth several dollars. The excitement is not allayed, however, and will not be until the block is split open and we know how it looks on the inside. It is a very bad thing to split open a block at the mine, and contrary to all rules, for there is danger that the fine, polished faces will be scratched.

Toll-line Switchboard at Waco.

Among the independent exchanges in the Southwest that of the Independent Telephone company of Waco, Texas, is one of the most notable. This company is one of the strongest independent companies in opposition to the Bell system in the Southwest. It is building an exchange at Waco and connecting up towns in the central part of the state with a network of toll lines.

The company is putting in a strictly copper-metallic system throughout and sparing no expense to put in the best system possible. The exchange will

TOLL-LINE SWITCHBOARD AT WACO.

be built with strictly multiple switchboard and a "central-energy system" will be put in operation. A large number of toll lines will center at Waco. The equipment used is manufactured by the Stromberg-Carlson Telephone Manufacturing company of Chicago.

The cut shows the toll-line switchboard. It is equipped for 30 divided-circuit toll lines. This system is claimed to be equal, if not superior, to the regular bridging system, and it does not infringe the Carty patent. The instruments used on the toll lines are the regular individual-generator-call and local-

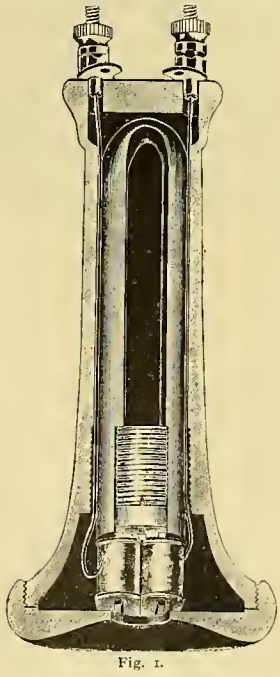
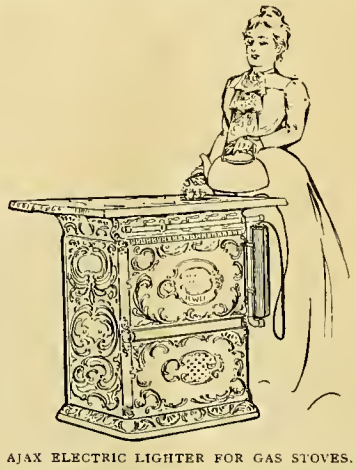


Fig. 1.

battery instruments and will be connected direct with the "central-energy system."

Ajax Electric Lighter for Gas Stoves.

The device illustrated herewith consists of a Russia-iron cylinder 16 inches long and 2¾ inches diameter, with polished brass caps on each end and brass split rings for attaching it to the stove. There are two cells of battery used, and they are connected in series. They can be easily removed and new cells inserted by simply slipping off the brass cap on the lower end of cylinder, which is arranged to fasten itself to the cylinder by a slight twist. On the inner side of the cap is a spring which forces the battery against the terminals of the spark coil, thus making complete connection. The hand-piece or sparker is connected to the cylinder by a cord sufficiently long to reach any burner on the stove, and is of a unique pattern, so arranged that it is



AJAX ELECTRIC LIGHTER FOR GAS STOVES.

almost impossible to short-circuit the battery by laying the sparker upon metallic substances.

The Advance Specialty company, Chicago, is putting this device on the market, and it has some flattering testimonials. The lighter is in use by a number of the gas companies, which are said to be highly pleased with its operation. It makes an ornament to the stove when attached, and is so practical that it will last a lifetime. Another claim is that the device is safe in the hands of children, as it is impossible to light anything except gas or gasoline or like substances.

Warner Telephone Generator.

Much time and ingenuity have been expended by inventors in designing a simple, durable and efficient motor-generator for signaling and other purposes. Among those who have gained considerable success in this line is W. F. Warner, who recently developed a battery generator to be operated by primary or storage batteries. It will give the smaller exchanges the benefit of power for ringing subscribers without the use of the hand generator.

The illustration gives a good idea of the general appearance of the machine. It is mounted upon a cabinet which has rollers, so as to be conveniently moved around. The cabinet is composed of two separate boxes, one on top the other, which are fastened together with screws. The large box at the bottom contains the batteries which furnish

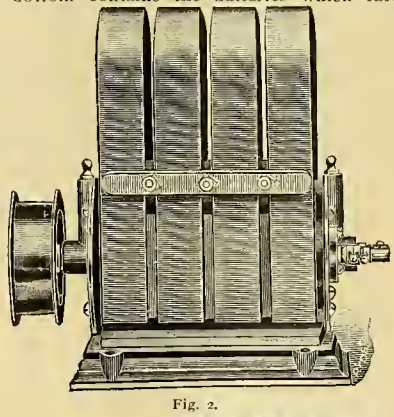


Fig. 2.

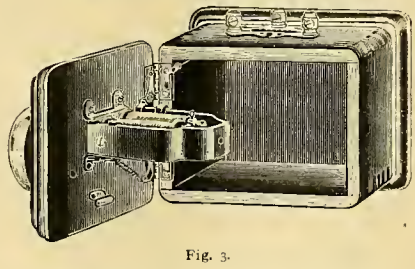


Fig. 3.

WILLIAMS-ABBOTT RECEIVER AND MAGNETOS.

the power for ringing, and in the small box at the top is contained the primary battery which furnishes power to keep the machine in motion. The instruments are mounted upon a marbleized-slate base, and have all parts finished in black enamel and nickelplate.

The cabinet is finished in either dark oak or cherry stain, and presents a handsome and pleasing appearance. The generator requires no attention after being started, no oiling or adjusting; nothing about it to get out of order and make trouble. It can be run continuously until the batteries are completely exhausted, if so desired, and, owing to the fact that there is little or no wear on the machine, it should last indefinitely with proper care.

The maximum cost of operation will never exceed 50 cents per month per 100 subscribers, and in most cases will not exceed half that amount, so it is the cheapest power as well as the most convenient and reliable.

The battery used is the Gordon closed-circuit type—largest size, with enameled-steel jar. It will operate the machine from five to eight months without stopping or recharging. With each machine are furnished dry cells sufficient to operate an exchange of 300 subscribers for six months under ordinary conditions, and it will ring through 50,000 ohms.

The William F. Warner company, Muncie, Ind., manufactures this generator.

Williams-Abbott Receiver and Magnetos.

The accompanying illustrations show some of the features of the excellent telephone apparatus made

WARNER TELEPHONE GENERATOR.

by the Williams-Abbott Electric company of Cleveland. The advantages claimed for the receiver (Fig. 1) are high efficiency, strength, durability and simplicity, and the absence of all complicated parts and objectionable devices found in other instruments. The magnet of this receiver is provided with a positive two-motion adjustment, to and from the diaphragm, and once adjusted, it can be locked fast at any point, so that any amount of jar or rough handling cannot change it while in use. The magnet, soft steel poles and coils are strongly mounted together as one piece, self-contained, and this in turn is rigidly held only at the front end of the hard rubber shell near the diaphragm. The back part of the magnet does not touch the rubber tube; hence, expansion and contraction of the parts caused by change in temperature will in no wise affect the adjustment between the poles and diaphragm. Only

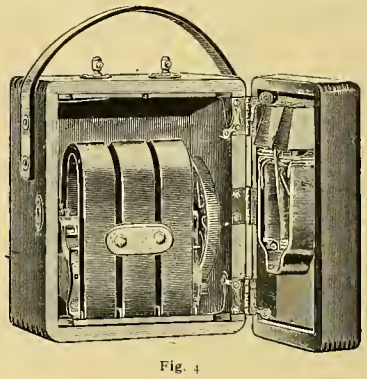


Fig. 4.

the best steel is used in the magnets, which are powerful and well proportioned, the ends being accurately milled and fitted to form perfect alignment with the soft steel pole-pieces that are bolted firmly to the arms of the magnet.

A non-magnetic threaded block (of hard white metal) is bolted between the pole-pieces and flanged to hold the magnets straight and firm, and also provided with lugs for set screws. A slight turn to the right or left accomplishes the adjustment, while the

pointed set screws, engaging with the shoulder of the shell, lock the whole fast and also hold the threads of the block firm and equal in the threads of the shell.

The hard-rubber shells are of the most approved pattern, strong, neat and compact, with diaphragm chambers properly proportioned to get the best results. All parts of the receivers are carefully made, assembled, adjusted and tested before leaving the factory.

In the company's well-known line of magnetos, power generators and other devices, several important improvements have also been made. The power generator, shown in Fig. 2, is of improved design, and carefully constructed of the best material, especially intended for exchanges that want a first-class and reliable piece of apparatus. It is made in two sizes, one for 75,000 ohms and the other for 150,000 ohms capacity, and can be arranged for either flat or round belt. Grease cups over the bearings avoid the dripping of oil and provide constant and efficient lubrication.

The hand generator is the form so long and successfully used in the company's celebrated magnetos. It has wide-cut gears and is furnished with the company's reliable centrifugal shunt. It is compact, durable and efficient, and is made with the same careful workmanship as the larger ones.

In Fig. 3 is shown the company's well-known three-pole ringer encased in a box. The peculiar construction produces an increased magnetic action. Being self-contained and very powerful, it is an efficient device, and the magnets on each side protect the coils from mechanical injury. As the cut shows, this ringer, put up in a separate box, forms an extension bell, very compact and convenient for auxiliary service.

For the use of inspectors and testing purposes in general a neat and compact test bell has been designed, as shown in Fig. 4. It is strong enough to ring through grounds of high resistance and is a useful and well-designed piece of apparatus.

Electrical Study in the Far North.

The expedition which Dr. Leopold Kann and his party are soon to make to Ellesmere Land, west of Greenland, in connection with the United States Arctic Geological Survey, promises to be of great interest and fruitful of results of scientific value. Dr. Kann, says an Ithaca correspondent of the New York Tribune, goes mainly for the purpose of studying the phenomena of atmospheric electricity, a force which is probably responsible for the familiar "heat lightning," aurora borealis, etc. It cannot be studied successfully in this latitude, on account of the vapor in the air; but in the Far North the conditions are altogether favorable, the vapor being all frozen, and the air therefore dry. Furthermore, the electric currents there are not impeded in their progress by any trees or any of the monuments of civilization, the country being altogether waste. Dr. Kann is now at work upon some electrometers, by which, when perfected, he hopes to make a series of accurate measurements of the electric currents of that latitude, for the purpose of demonstrating, if possible, the connection between atmospheric electricity and the rotation of the earth on its axis.

Lineman Killed on a Pole.

"Eternal vigilance is the price of safety." The need of unceasing watchfulness in handling high-potential circuits is again and again impressed on men engaged in electrical pursuits, but at too frequent intervals they grow careless and over-confident, with the result that a severe accident, perhaps a death, is added to the long list of preventable casualties. Edward Moody, a lineman of the Commonwealth Electric company of Chicago, was killed while at work on a pole on the night of June 24th, and as it seems evident that his death was nobody's fault but his own, his sad fate gives one more warning. He was employed in the northern division of the Commonwealth company's territory, and was at work on a pole at Southport and Lincoln avenues. The night was dark; he was in a hurry to make a connection because lights were out that should be burning; he neglected to use insulating gloves and got both bare hands on the exposed sides of a 1,000-volt alternating-current electric-lighting circuit. He received the full strength and pressure of the current through his body and was instantly killed.

Exhibition of Automobiles in Paris.

Paris correspondents report that the automobile show in the Tuilleries Gardens is a great success, both from a technical and popular point of view. It is said that the number of vehicles displayed runs into the hundreds, and that the exhibits are valued at over $500,000. Electric carriages and wagons are particularly numerous and attractive. It is said that the tendency of the French manufacturers of automobiles for pleasure riding is to make small vehicles, seating two or three people, and costing from $700 to $1,200. However, a number of self-propelled omnibuses and wagonettes are also on exhibition.

A. A. Sowers, secretary and general manager of the Marietta (Ga.) Telephone company, has completed arrangements with the Standard Telephone company of Atlanta for a connecting line between Marietta and Atlanta.

International Congress of the Paris Exposition of 1900.

By Francis E. Drake,

Director of Machinery and Electricity for the Commissioner-general of the United States.

The Universal Exposition of 1900 is certain to prove a Mecca to a great number of scientific men and engineers. This gathering together of technical men from all parts of the world justifies the French electricians in their efforts to organize an international electrical congress, which has already received the official patronage of the French government. In previous conferences questions of units and nomenclature have been settled by international agreement, to the great advantage of all concerned. Since the international electrical congress at Chicago in 1893 there have been unexpected discoveries in the application of what seemed once to belong to pure science and an extraordinary expansion of the various electrical industries. Engineering practice has thus awakened an interest in a great number of problems on which it will be interesting and profitable to have the views of technical authorities. The discussions of the proposed congress will, therefore, have a character at once both industrial and economic.

The work before the proposed congress is provisionally divided as follows:

(1) Scientific methods and instruments of measurement.

(2) Production of electrical energy, transformers, distribution, electric lighting, traction.

(3) Electro-chemistry, electro-metallurgy, accumulators, electric furnaces.

(4) Telegraphy, telephones and various applications.

(5) Electro-physiology.

The congress will last one week, beginning Friday, August 18, 1900.

The administration of the exposition has arranged with the commissioner-general for the United States for the appointment, under him, of an official delegate with headquarters in Paris, and through him all correspondence and plans of the organization may be transmitted. The commissioner-general has wisely named as his official delegate, under this agreement, the assistant commissioner-general, who is in constant touch with the authorities and abundantly able to conduct any conferences which may be required prior to the opening of the congress.

The method of choosing delegates will be proposed by the authorities at a later date, and a subscription for membership has been placed at 20 francs, merely a nominal fee to apply toward the current expenses of the reporting staff.

Any communications which may be directed to the commissioner-general, at either New York or Chicago, will receive prompt consideration. It is to be hoped that an early conference may be held with the American Institute of Electrical Engineers and other scientific bodies interested in this work, so that proper representation from the United States may be assured.

Cleveland Street-railway Strike Ended.

On Saturday last a settlement was reached in the strike on the "Big Consolidated" street-railway system of Cleveland. A special committee of the City Council acted as mediator between the company and the men, and an agreement, with the stipulations following, was reached:

1. Restoration of former schedule.
2. In the matter of extra runs and wages therefor the company will treat with men, and in case no agreement is reached, they will arbitrate.
3. Questions of wages and schedules will not be arbitrated, but the company will receive employes in an effort to adjust them.
4. In matter of discharge of employes a man shall have a hearing, given full opportunity to explain. Hearing to take place before representatives of men and company.
5. Question of reinstatements to be as previously agreed upon in original proposal, viz., 80 per cent. of all old employes taken back at once, 20 per cent. to be on waiting list, etc.

It is considered that the company won the strike, but at a tremendous cost. The loss to the Big Consolidated was about $100,000; the gain to the Little Consolidated, the parallel line belonging to Senator Hanna, is placed at $30,000. The 770 men have lost $30 apiece.

Street-railway Interests of Greater New York Said to Be Consolidated.

A New York dispatch to the Chicago Record, dated June 29th, is as follows: "A gigantic alliance has been formed and all the details nearly completed that will place all the street-car and elevated lines in Greater New York under one control. The plan, in a word, is the amalgamation of the Metropolitan Traction company's interests with those of the Manhattan railway and the Third Avenue lines in this borough, and with the Brooklyn Rapid Transit company. George Gould, who manages the fate of the Manhattan railway and its $48,000,000 of securities, is in Philadelphia conferring with P. A. B. Widener, the moving spirit in Metropolitan Traction. The directors of the Traction company authorized an issue of $5,000,000 of stock to-day."

The present capitalization of the four companies named is about $175,000,000.

Butte County Long-distance Transmission.

The West has been prolific in utilizing water power for long-distance electric transmission. One of the latest plants is that of the Butte County (Cal.) Electric Light and Power company, for which the electrical apparatus is in course of construction. The central power house will be at Butte Creek, containing two 400-kilowatt Westinghouse "engine-type" two-phase generators, at 500 volts and 7,200 alternations. The generators will be direct-connected to turbines, which will work at 400 revolutions per minute. Upon the ends of the shafts will be placed two 5½-kilowatt exciters. A complete switchboard will be provided with the latest devices for manipulating the system. The equipment will include two sets of generator fuse-blocks of 600 amperes capacity, mounted on marble slab, and six Wurts lightning arresters for 14 amperes and 16,500 volts. The current, at 500 volts, two-phase, delivered by the two 400-kilowatt generators, will be carried to the primaries of four Westinghouse raising transformers, each of 200 kilowatts capacity, and will be delivered by the secondaries of the transformers at 16,500 volts, three-phase, to the long-distance transmission conductors. The transformers will be complete with spark-gap arresters.

Two sub-stations will be installed, one at Chico, 11 miles distant, and the other at Oroville, 23 miles distant. From these points the current will be distributed for commercial purposes. The transmission wires, for both sub-stations, are carried upon the same poles through the town of Centerville, and thence branch off to each sub-station.

At the Chico sub-station will be installed two Westinghouse lowering transformers, each of 200 kilowatts, with 15,000-volt, three-phase primaries, and 2,000 to 1,000-volt, two-phase secondaries, complete, with spark-gap arresters. A switchboard will be equipped, and the station will be protected with three Wurts lightning arresters. The current will be applied for lighting and power in the proportion of 75 per cent. for the former and 25 per cent. for the latter.

At the Oroville sub-station, 23 miles distant from the central power house at Butte Creek, the current is received by six 25-kilowatt Westinghouse lowering transformers, with 15,000-volt, three-phase primaries and 400-volt, two-phase secondaries, complete, with spark-gap arresters. The current at this sub-station will be used in the proportion of 10 per cent. for lighting and 90 per cent. for power. At Oroville the Kia Ora Gold Dredging company is carrying on extensive operations, using a large number of Westinghouse induction motors for operating dredgers, for centrifugal pumps and for the washing trays, the power being provided by the Butte Creek transmission system.

TRIFLING TECHNICALITIES.

The Chicago Record thinks it necessary to revise an old adage. "Never," it says, impressively, "look a gift automobile in the works."

There is an automobile show in progress in London. A bad roads exposition with an automobile show on the side would be a good thing in this country.—Minneapolis Times.

Automobile or ought not to mobile seems to be the question at issue between the South Park commissioners of Chicago and the owners of several hundred power-propelled vehicles.—St. Louis Republic.

Agent—"Do you think I could sell your father a lightning rod, little boy?"

Boy—"Nope! Dad's already got one rod an' dat's got enough lightning in it to burn me an' der dawg up wid."—Chicago Daily News.

A new definition of science is implied in a story lately told by Canon MacColl: "A friend of mine once shared the box-seat with the driver of a stage coach in Yorkshire, and being a lover of horses, he talked with the coachman about his team, admiring one horse in particular. 'Ah,' said the coachman, 'but that 'oss ain't as good as he looks; he's a scientific 'oss.' 'A scientific horse,' exclaimed my friend, 'what on earth do you mean by that?' 'I means,' replied Jehu, 'a 'oss as thinks he knows a deal more nor he does.'"—New York Evening Post.

Telegraphers' Annual Gathering.

[Special correspondence of the Western Electrician.]

Boston, June 23.—Vice-president H. J. Pettingill of the Michigan Telephone company gave a banquet on June 22d, at Young's Hotel in this city, to the general committee of arrangements and entertainment having in charge plans for the annual meeting of telegraphers in Boston in September next. Mr. Pettingill is president of the organization known as the Old-Time Telegraphers' association, and is much interested in the prospective annual gathering of the "experts."

Among those present at Mr. Pettingill's invitation were: G. H. Yetman, superintendent of the Boston district messenger service; F. T. Viles, city inspector Western Union company; D. J. Hern, general manager Mutual district messenger service; J. H. Wentworth, cashier Western Union company; Henry C. Sherman, superintendent's department Western Union company; William E. Durgin, superintendent American Telegraph and Telephone

company; C. E. Bagley, Manager Postal company; I. O. Wright, superintendent New England Telegraph and Telephone company; C. W. Henderson, manager Western Union company; E. B. Pillsbury, superintendent Postal company; Edgar A. Smith, superintendent of telegraph of the Fitchburg railroad; J. W. Larrish, electrician Western Union company; E. M. Fisher, chief operator of the Associated Press; W. H. E. Clapp, cashier Boston district messenger service; Rufus R. Wade, chief Massachusetts district police; Thomas W. Flood, Boston commissioner of wires; W. J. Denver, assistant general manager New England Telegraph and Telephone company; S. A. D. Forristall, superintendent of telegraph of the Boston and Maine railroad.

At the business meeting after the dinner committees were appointed as follows:

Arrangement and banquet—H. J. Pettingill, W. J. Denver and Rufus R. Wade.

Transportation—S. A. D. Forristall, John Brant, E. A. Smith, J. W. Larrish and D. J. Hern.

Reception—J. W. Larrish, J. H. Wentworth, C. W. Henderson, C. E. Bagley.

Press—E. P. Pillsbury, J. H. Fahey and E. H. Fisher.

CORRESPONDENCE.

New York Notes.

New York, June 27.—It is now stated that the actual work of substituting electric power for steam on the Manhattan elevated railroad system will be begun in August. The contract for 9,000tons of third rails has also been awarded. Mr. W. E. Baker, the electrical superintendent of the company, has a large staff of men at work on the plans at 32 Park place. It is understood that no one company will receive the contract for the work.

The change in the control of the United Electric Light and Power company was made last week, eight out of the 13 old directors retiring. The company has been closely connected with the Westinghouse interests, and it has been about the only important electric-light property that had not been absorbed by W. C. Whitney's New York Gas and Electric Light, Heat and Power company. Some time ago it was reported that the Third Avenue Railroad company was likely to secure the United company, so that it might utilize its plant and subways to compete with the Metropolitan Street Railway in electrical light, heat and power distribution. More recently it was asserted that the United company would be turned over to the Consolidated Gas company, which would utilize it as a factor in the gas war. George Westinghouse, Paul D. Cravath, George W. Hebard, C. H. Jackson and Ph. Ferd. Kobbe were re-elected directors. The new directors elected were George H. Church, George H. Rae, Benjamin Whiteley, Cortland Betts, Arthur Starke, Osborn W. Bright, Joseph F. Sweasy and A. Murray Young. They take the places of Brayton Ives, Marcellus Hartley, C. J. Canda, August Belmont, Henry B. Hyde, who died recently, Charles F. Adams, Duncan D. Parmly and James Stokes.

There are rumors of a strike among the employes of the Brooklyn Rapid Transit company's system of transportation lines, but President Rossiter denies absolutely that he has received a single complaint from the men on any of the lines. It is known, however, that the motormen and conductors on the Nassau system have been discontented since they have been working under the regulations of the Brooklyn Heights road. Formerly, under the Johnson regime, these men were paid by the hour; now they are paid by the trip. This, they declare, has resulted in smaller earnings for them, and there has been much complaint. President Rossiter and the other officials of the Rapid Transit company believe that the Brooklyn Heights employes will stand by them, and that the men of the other lines will not dare to strike without their aid. Mr. Rossiter says that he is ready at any time to receive personally any complaints from his men, either for themselves or as representatives of their comrades.

A special meeting of the stockholders of the Third Avenue Railroad company has been called for July 10th, when a proposition to increase the capital stock of the company from $12,000,000, the present amount, to $40,000,000 will be voted upon. The new stock is to be issued for the purpose of paving the company's floating debt, incurred in the acquisition of the securities of other street railways, and for changing the motive power of the Third Avenue line and the acquired lines. Fifteen millions of the $28,000,000 of new stock, it is estimated, will be devoted to paying the cost of the improvements in progress and in contemplation.

On July 1st the Manhattan Electrical Supply company will advance the wages of all employes who have been in its service one year at the factory in Jersey City 10 per cent. The advance will affect about 200 employes. M. S.

Northwestern Notations.

Minneapolis, June 26.—During the recent flood in southern Minnesota, the water got so high at Chatfield that the wheel got fouled and could not be shut down at the electric-light plant. The engineer therefore had to watch and wait till he was relieved, which was not till the middle of the following day. The succeeding day there was so much backwater at the power house that it was impossible to run the water-wheel, and the engine had become disabled, so the plant could not be operated by steam.

The Street Railway company of Duluth, Minn., is preparing to change its rolling stock from short cars to double-trucked cars of about the same patterns as those on the interurban lines between Minneapolis and St. Paul.

The Seattle Cataract company has made a proposition to furnish the city of Seattle, Wash., with electric light for 10 years, with 300 arc lights, at $6.30 each a month. The system is to become the property of the municipality at the end of that time.

R. G. Wieland of Duluth, Minn., has been granted a franchise for electric lighting in Duluth, Minn. He proposes to have the system in operation in 90 days.

The council of Duluth, Minn., is considering a plan to operate the proposed new electric-light plant by gas instead of steam power. It is proposed to have the plant at the gas-works. The city engineer is collecting figures as to the comparative cost of steam and gas, and so far they favor gas.

It is reported from Stillwater, Minn., that the Stilwell & Bierce company of Dayton, O., has secured the ownership of the Apple River Falls dam, just across the line in Wisconsin, and proposes to transmit electric power to St. Paul, 30 miles.

The Tri-city Railway company of Davenport, Ia., has let the contract for the erection of an addition to its shops, to cost $13,000. The building is to be completed by September 1st. The company will experiment with fenders on its cars and test them with dummies.

W. B. George has applied for a franchise to operate an electric street railway in Billings, Mont.

It is understood the street railway in Sioux Falls, S. D., is soon to be transformed into an electric-car line.

The attempt to sell the Edison building in Minneapolis has produced but one bid, of $47,550, from Carter, Rice & Co. of Boston. On the advice of the attorneys the court rejected the bid. The building is held to be worth from $75,000 to $125,000 by the creditors.

The Des Moines Edison Light company announces that as soon as its improvements are completed rates will be cut 50 per cent. on all kinds of lighting, and the company will go after business with a vim. The improvements projected will cost $50,000.

Warren B. Steere of Des Moines, Ia., is an applicant at Nevada, Ia., for a franchise to build and operate an electric-car line, which he proposes shall go from Nevada to Ames and to Des Moines.

The Twin City Rapid Transit company has purchased a building in Stillwater, Minn., for a power house and repair shops.

The council of Grinnell, Ia., has taken action to reduce the meter rate per thousand volts of electricity from 15 to 10 cents. The proprietors of the electric-light plant say they cannot furnish light at a less rate than 15 cents. J.

PERSONAL.

Prof. E. L. Nichols of Cornell University will spend his summer vacation in Europe.

Mr. A. E. Brooke Ridley, a prominent San Francisco electrical man, was in Chicago early in the week on a busines errand, which was highly successful.

General Leonard Wood, of "Rough Riders" fame and later military governor of the province of Santiago, Cuba, has been offered the presidency of the newly formed Washington (D. C.) Traction company and is considering the matter.

Professor Bovey of the faculty of applied science of McGill University, Montreal, has been elected a member of the Council of the Institute of Civil Engineers of England. Many electrical men in the United States are acquainted with Professor Bovey and will rejoice at his new distinction.

Mr. Charles G. Burton, one of the best-known and most experienced electrical salesmen in the West, has become a member of the selling force of the Westinghouse Electric and Manufacturing company at Chicago. Mr. Burton's electrical experience dates back 15 years, and he has been connected with the Brush, Central Electric and Sprague companies. His services should prove a decided acquisition to the Westinghouse company.

Mr. Truman P. Gaylord, formerly associate professor of electrical engineering at the Armour Institute of Technology and later connected with the Chicago Edison company, has accepted a position as a member of the staff of the Chicago office of the Westinghouse Electric and Manufacturing company. Mr. Gaylord's duties will require the qualifications of both an engineer and a salesman, and will give his well-recognized technical ability a wider outlook and a more diversified utility.

Samuel Insull, the prominent Chicago electrical man, is president of the Illinois Electric Vehicle Transportation company, among his other activities, and now he has more reason to be opposed to the cab-horse than ever. He was crossing the street at Wabash avenue and Jackson street on Saturday last when he was knocked down by a runaway horse attached to a cab. The horse became frightened at the noise of the elevated railway, and was upon the pedestrian before the latter was thoroughly aware of the danger. Mr. Insull was knocked down and severely bruised and cut about the head and body. He was taken to the Auditorium, where he had a luncheon engagement with Mrs. Insull, and where a surgeon dressed his injuries, which proved painful rather than serious. Mr. Insull was prevented from going to his office for several days, but is now about again.

Thomas J. Johnston has opened an office in the Park Row building, New York, for the practice of law, his especial province being the conduct of patent causes, either in the courts or the United States Patent Office. Mr. Johnston was admitted to the bar 17 years ago, and for six years past he has been retained by the General Electric company in its patent department as an assistant to Frederick P. Fish, the well-known patent counsel. He has a wide acquaintance among electrical men.

ELECTRIC LIGHTING.

Lee & Sayers have been granted a franchise for the establishment of an electric-light plant at Abbeville, La.

The city of Manchester, England, has accepted the bid of the Westinghouse company for four engine-dynamos of 1,800 kilowatts capacity each for the Bloom street station.

The city of Lake Providence, La., will make immediate arrangements for the construction of water-works and electric-light plant to cost $17,500. Arthur B. Hider of Greenville, Miss., will make plans and specifications, and contracts will be let probably in August.

The city of Colmar, a town of 35,000 inhabitants, 40 miles southwest of Strasburg, Germany, already owns its own gas-works and water-works, and the council has just decided to spend about $60,000 in the erection of an electric-light and power plant, which will furnish current also for the city's street railways.

Boiler explosions in electric-light plants are comparatively rare, but occasionally one takes place. A press dispatch states that the boilers of the electric-light plant at Fairview, Ill., blew up a few days ago, injuring three persons, one of them mortally. Fairview is a village of 500 inhabitants in Fulton County, and the plant must have been a small one, perhaps operated in connection with some other manufacturing establishment.

C. W. Jackson was given permission at a recent meeting of the Chicago City Council to lay electric-light wires in the alley running north and south between State street and Plymouth court and Jackson boulevard and Van Buren street. The grant is for the sole purpose of supplying electric light. Ten per cent. of the gross receipts is to be paid to the city as compensation on January 10th of each of the 20 years of the life of the grant. At the expiration of that time the city is to have the privilege of purchasing the plant.

ELECTRIC RAILWAYS.

The Yesler Way cable road at Seattle, Wash., is being transformed into a double-track electric line on two prominent thoroughfares, extending from the water front to Lake Washington.

The new United Railways and Electric company of Baltimore will erect new car shops and barns on a site just purchased at a cost of $70,000. It is said that there will be 13 separate stone buildings.

It is stated that the Buffalo Street Railway company will spend $1,000,000 in improvements this year. Almost $350,000 worth of electrical machinery, it is said, has already been ordered from the General Electric company to equip five stations.

At a recent riot at Seoul, Corea, 10 cars owned by the electric-railway company recently established there were smashed and burned and several of the tramway employes were killed. A number of Japanese and European motormen saved their lives by flight. The cars had killed several children since the service was opened in Seoul.

The government has begun a suburban electric-car mail delivery in Chattanooga and suburbs. W. C. Heckman, assistant superintendent of the United States Railway Mail Service, arranged the service with officials of the Chattanooga Electric Railway company. This is an innovation for the South that will probably be followed in other cities of that section.

It is announced that as Governor Stephens has signed the street-railway bill, the negotiations for a general consolidation of all the street railways of St. Louis, which have been in progress for some time, have been practically completed. The deal involves nearly $100,000,000. Brown Bros. of New York are said to be handling the financial end of the deal. Without the Suburban, which has not yet come into the combination, the consolidated company will have 295 miles of single track, and including the Suburban and new track to be constructed it will have nearly 400 miles. Over $5,000,000 will be expended in improvements, it is said, and a much larger number of men will be employed than before.

At the annual meeting of the Metropolitan Street Railway company of Kansas City the Armour interest came into control of the property. The earn-

ings for the last year were at the rate of 7½ per cent. on the capitalization—$5,500,000. The company now controls all the street-car lines of Kansas City. The board of directors, just elected, includes Charles Francis Adams of Boston, Norman B. Ream and P. A. Valentine of Chicago, and Charles W. Armour, L. E. James, C. F. Morse, W. H. and C. F. Holmes and Wallace Pratt of Kansas City. The officers are: Chairman of the board, P. A. Valentine; president, W. H. Holmes; vice-president, L. E. James; general manager, C. F. Holmes; secretary and treasurer, W. E. Kirkpatrick. Mr. C. F. Morse was the former president, with Mr. W. H. Holmes as manager and Mr. C. F. Holmes as superintendent.

AUTOMOBILES.

A certificate of incorporation of the United States Vehicle company, with an authorized capital of $25,000,000, was filed at Dover, Del., on June 23d. The company is incorporated for the purpose of manufacturing vehicles to be operated by compressed air as motive power.

The reports of exports to foreign countries for the week ended June 21st show that American manufacturers of automobiles shipped 10 cases containing self-propelling vehicles, worth $15,212, to Havre, France. There, it is said, the automobiles will be mounted and shipped to other lands.

A New York paper says that the Fischer Equipment company of Chicago has been commissioned by the firm of Frederick Loeser & Co. of Brooklyn to construct a number of automobile delivery wagons. They are to be built and delivered as soon as possible, and the firm believes that it will be the first in Brooklyn to introduce automobile delivery wagons.

It seems that the automobile industry is to have the benefit of Mr. Edison's inventive genius. A dispatch from Orange, N. J., states that Thomas A. Edison is at work on an electric automobile, which he believes will be far ahead of anything that the French or American inventors have as yet turned out. He declines to make any statement about it or the principle on which it is to be constructed, but will say that it can be made for a comparatively low price, and that his plan will enable the machine to run for 150 miles without recharging the batteries.

The Riker Electric Vehicle company has been incorporated under the laws of New Jersey, with a capital of $2,000,000 six per cent. preferred stock and $5,000,000 common stock. The company will purchase all the patents, machinery, contracts and rights of Andrew L. Riker and the Riker Electric Motor company for the manufacture of electric vehicles. It will purchase the extensive works at Elizabethport, N. J., which are said to have a capacity of five completed vehicles a day. Among those connected with the company are Andrew L. Riker, Charles A. Lieb, president of the Great Falls Power company of Washington, O. T. Crosby of Washington and F. C. Stevens, president of the West End Bank, Washington.

The Automobile company of America, with headquarters in New York city, was incorporated on June 21st, under the laws of West Virginia, with a capital of $20,000, which may be increased to $2,500,000. It will confine its operations for the present to the manufacture of pleasure vehicles propelled by gasoline. The vehicles, it is said, will weigh only about 500 or 600 pounds, and will be cheaper than the electric automobiles. A test of these vehicles, in competition with automobiles propelled by electricity and other motive powers, is to be made this month in a road race which will be held at Ardsley, and the arrangements for which are being made by John Brisben Walker of Irvington-on-the-Hudson, N. Y.

An ordinance was submitted by Alderman Kunz in the Chicago City Council on June 26th, granting the Auto-stage company a franchise to operate a line of horseless vehicles through all the streets of the city. The life of the franchise is put at 20 years, and the automobile lines are to be operated for the exclusive use of passengers. For the first 10 years a compensation of one per cent. of the gross earnings is offered and three per cent. for the remainder of the term. The fare in the ordinance is fixed at five cents for any distance between the terminals. Madison street and Wabash avenue is named as the downtown terminus. Transfers are to be given and a license fee of $10 a year for each automobile is provided for. The ordinance was sent to the judiciary committee.

PUBLICATIONS.

Bulletin No. 2225, describing Bullock multipolar generators and motors, will be sent to those requesting it.

G. Freytag & Berndt of Vienna publish a colored chart showing graphically the development of the telephone in Austria from 1881 to 1899.

The G. P. Magann Air-brake company of Detroit thinks that it has solved the problem of braking cars on electric street railways. It publishes a pamphlet, "Storage Air-brake System," which seems to be carefully prepared and which should interest street-railway men.

Secretary R. W. Pope has issued Volume XV. of the Transactions of the American Institute of Electrical Engineers. The volume comprises 812 pages and includes the papers read at the meetings held in the year 1898 and also a catalogue of members, brought down to May 1, 1899.

"Electricity for Printers" is a very neat and tasteful brochure; probably it was printed on an electrically driven press. It shows the peculiar advantages of electric drive in the press-room, and such is the restraint and good taste in its preparation that one must look closely to discover that it was issued by the Crocker-Wheeler company.

POWER TRANSMISSION.

Contracts have been let, according to a somewhat mysterious Omaha dispatch to the Chicago Record, for the construction of a canal and reservoir at a point about 50 miles from Omaha, to cost more than $2,000,000. The power will be transmitted to Omaha. Provisional contracts have been made with all the big power-users, it is said. Especially at South Omaha, the introduction of a much cheaper power is expected to prove of material assistance to the packing industry and push the town ahead of its competitors as a meat-packing center. General B. N. King of Dayton, O., together with a syndicate of New York and London capitalists, is named as concerned in the enterprise.

A company has been formed for the development of the power of Ivy Creek, near Marshall, N. C., the project having been under consideration several months by Charles A. Reynolds of Winston, N. C., and his associates. There will be constructed a cement-and-rock dam, 110 feet long at bottom, 340 feet at top, 60 feet thick at bottom, tapering to six feet thick at top. The race will be blasted out of solid rock. The power plant will be located 300 yards down the river, and electricity will be generated for transmission to Asheville, 14 miles. The water will pass through a 100-foot solid-rock tunnel into an iron flume. The two pairs of turbines will be 27 inches in diameter, each furnishing 1,000 horse power, and will be connected directly to the dynamos. Four thousand horse power is available, but only half of it will be used.

TELEGRAPH.

The capital stock of the new Illinois District Telegraph company of Chicago has been increased from $100,000 to $200,000.

The Western Union Telegraph company has commenced suit in the United States Court at Topeka, Kan., to enjoin the State Court of Visitation from putting into effect the new law which reduces telegraph rates 40 per cent. It is claimed by the company that the new rates are confiscatory.

The Western Union Telegraph company reports as follows for the quarter ended June 30th: Net revenue (partly estimated), $1,650,000; decrease, as compared with the corresponding period of last year, $27,262; interest, $224,273; decrease, $144; balance, $1,425,727; decrease, $27,118; dividends, $1,216,987; increase, $5; surplus, $208,740; decrease, $27,118. For the year: Net revenue, $5,866,003; decrease, $224,147.

Frank W. Hawley, president of the West Indies Telegraph and Cable company, arrived in New York recently. "Cables will be laid from New York to Cuba soon," said Mr. Hawley, "and there will also soon be built a gridiron of telegraph and telephone lines on the island. Cuba's facilities of this sort are now inadequate, and many of the interior towns have no telegraph connection with the coast. The capital for the development of this enterprise is largely New York and European."

The board of directors of the Central and South American Telegraph company has elected the following-named officers for the year: President, James A. Scrymser; vice-president, Charles Lanier; resident vice-president, Sebastian Camacho, City of Mexico; treasurer and auditor, Samuel C. Blackwell; secretary, James R. Beard; executive committee, William Gaston Hamilton, William R. Grace and John L. Riker. The usual quarterly dividend of 1½ per cent. was declared.

At a meeting of the directors of the Mexican Telegraph company last month the following-named officers were elected for the year: President, James A. Scrymser; vice-president, Edmund L. Baylies; resident vice-president, Sebastian Camacho, City of Mexico; treasurer and auditor, Samuel C. Blackwell; secretary, James R. Beard; executive committee, John E. Alexandre, Percy R. Pyne and William Emlen Roosevelt. The usual quarterly dividend of 2½ per cent. was declared.

ELECTRICAL SECURITIES.

Chicago bankers offer $265,000 of first-mortgage, five per cent., 30-year gold bonds of the Decatur (Ill.) Gas and Electric company at 104 and accrued interest. It is said that the expenses of this company are 52 per cent. of the revenue, and that, on the basis of the business of the year ended April 30, 1899, the surplus revenue after paying bond interest is $19,000.

The subscriptions for the Chicago Union Traction company's stock were paid practically in full on June 26th, and the plan arranged was that Mr. Yerkes should turn over his stock in the North and West Side companies to the Illinois Trust and Savings Bank, receiving therefor $10,000,000, less the bank's commissions for handling the money and a sum estimated at $3,000,000, which it is said represents the sum Mr. Yerkes borrowed to carry out some of his traction enterprises in the past and what he subscribed to the stock of the Union company. His obligations in New York are supposed to amount to $2,000,000, so that he will have about $5,000,000 in cash when the transaction is closed.

Boston bankers offer a portion of the stock of the Massachusetts Electric Companies, the recently formed corporation which has absorbed 33 street-railway and electric-light companies in the thickly populated suburban district of Boston. These companies cover the greater part of the street-railway mileage north of Boston, as far as Nashua, N. H., and Newburyport and Gloucester, Mass., and south as far as Fall River, Mass., and Newport and Providence, R. I., connecting directly with the street-railway system of Boston. Various electric-lighting companies doing business in the same section are also included. The board of trustees is made up of Richard Olney, Charles E. Cotting, Eugene N. Foss, Percy Parker, Charles Francis Adams 2d, Gordon Abbott, Amos F. Breed, John N. Beckley, Stillman F. Kelley, Walter Hunnewell, S. Endicott Peabody, S. Reed Anthony, Everett W. Burdett, Philip L. Saltonstall and E. Rollins Morse. The trustees will issue $24,000,000 worth of stock, half common and half four per cent. preferred. Seventy thousand shares of the preferred stock and 35,000 shares of common are offered for public subscription on a basis of 105 for the preferred stock, one share of common stock being given as a bonus with every two shares of the preferred stock. It is reported that the street-railway companies in the combination have a total of 647.41 miles of track and that they own and operate 1,426 cars, of which 618 are closed and 808 open cars. The total number of power stations is 18, having a total rated capacity of 28,423 horse power.

MISCELLANEOUS.

Following the reading of a paper by John A. Sleicher of New York on "Street-car Advertising," the New York Press association, at its recent meeting at Niagara Falls, adopted a resolution calling the attention of the state authorities to the "illegitimate use of railway cars for advertising purposes."

A dispatch to the Chicago Chronicle from Laporte, Ind., says that Professor Talbert of that city, who is now in Germany, has discovered a way for a much wider and more scientific investigation of the action of the brain on the muscles of the body than has heretofore been known. It has long been known that stimulation of certain parts of the brain would cause definite responses from certain muscles of the body. Professor Talbert has hit upon the plan of trephining holes in a dog's skull, which he will fill with ivory plugs to which are attached electrodes resting on the surface of the brain. Wires are then attached to a battery, and the brain at these points is stimulated at will. The location of the part of the brain governing the leg, eye, nose, etc., may be found by this new plan.

TRADE NEWS.

Mr. R. M. Shaw, the representative of the Fort Wayne Electric Works for Southern Illinois, Missouri and the Southwest, has his office at No. 818 Lincoln Trust building, St. Louis, Mo.

The Dodge Manufacturing company of Mishawaka, Ind., has been incorporated in Illinois as a foreign corporation, with $30,000 capital stock. The capital stock of the Indiana company is $500,000.

Electra carbons are carried in stock by the Central Electric company of Chicago. These carbons are deservedly well known, as they are made of excellent material by most approved methods of manufacture.

The International Correspondence Schools of Scranton, Pa., have commenced suits against the United Correspondence Schools and the American School of Correspondence for infringement of copyright in instruction papers. They have issued a circular headed with the word "Caution," in which they set forth what they claim to be the salient facts in the case.

A summer stimulation often is demanded in business circles, as well as by the individual. The Central Electric company, Chicago, states that this season's demand for electrical supplies is of such a lively nature that no urging is required to gain fine orders. There is a generous support in all departments of electric installation, although without doubt the greatest activity is in telephone extensions.

Mr. V. E. Raggio, who for many years has been connected with the Commercial Electrical Supply company of St. Louis, Mo., has associated himself with the Western Electrical Supply company of the same city, and will travel through the Southwest in the interest of the latter company. Mr. Raggio has been very successful throughout this section of the country, and will, no doubt, continue to receive the liberal patronage of the past, as he will certainly be fully supported by the enterprising company with which he has connected himself.

The Westinghouse Electric and Manufacturing company has recently closed a contract with the Honolulu Iron Works company for an electrical equipment of its factories, to be shipped forthwith to the Hawaiian Islands. The contract comprises a 150-kilowat, 250-volt, compound-wound Westing-

house generator, to be belted to a steam engine driving the generator at 550 revolutions per minute. A marble switchboard will be provided, with the latest devices for manipulating the electrical apparatus, and also some Westinghouse electric motors for operating planing and drilling machines.

F. S. Hunting, treasurer and sales manager of the Fort Wayne Electric Works, Fort Wayne, Ind., spent a few days in Chicago last week in the interests of the Fort Wayne company. Mr. Hunting states that the new company is just starting out under most auspicious circumstances. The company is rushed with work, having recently received a number of handsome orders. The Fort Wayne Electric Works, as is well known, have one of the best equipped plants in the country, and are now in a better position to fill orders than ever before. J. J. Wood is the general superintendent and electrician. Mr. Hunting states that not only will the high standard of excellence attained by the Wood systems of electric lighting be maintained, but improvements will be made from time to time, as experience shall suggest.

BUSINESS.

Gates & Randolph of Chicago have sold 200 Sterling arc lamps to Armour & Co., Chicago.

Fortune Bros., 225 Desplaines street, Chicago, have placed an order with the Western Electric company to equip their buildings with an electric-light plant. All of the material will be of Western Electric manufacture, and the work will be installed by the construction department.

The Electric Appliance company, Chicago, is reaping the reward for enterprise in the large orders it is booking for "O. K. slow-burning weatherproof" and "O. K. slow-burning" or "Underwriters" wires. The promptness with which it placed these wires upon the market to meet the new requirements of the National Board of Fire Underwriters has been noted by the users of wire all over the country. These wires have been made to strictly comply with the rules of the National Fire Board relating to slow-burning wires for inside wiring.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, call special attention to their Mannocitin, said to be the only absolute rust preventive for machinery, engines, tools, guns, cycles and all metals. Mannocitin is composed of greases and volatile oils. It is and remains neutral and contains no acid. On application the oils evaporate, leaving an air-tight film or skin, which adheres tightly to the metal and prevents rust and corrosion. Mannocitin withstands salt air, salt water, rain, snow, dampness, perspiration, steam, gases and fumes of acids and ammonia.

The Council of Rangitikei County, New Zealand, has placed an order with the Berlin Iron Bridge company of East Berlin, Conn., for a highway bridge, consisting of a single span of 204 feet, designed to carry a distributed load of 1,500 pounds per lineal foot or a road engine weighing 40 tons. In transmitting this order the chairman of the Council says: "As far as I know, this is the first order of the kind sent to the United States, and the experiment is being watched by other local boards." The bridge will be a pin-connected structure on account of the ease and facility with which this class of construction can be erected in the field.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 20, 1899.

627,105. Apparatus for Lighting Car Lamps. Henry C. Farquharson, New York, N. Y. Application filed August 13, 1898.

The suspended gas lamp has a metallic chimney with electric conductors passing down through the chimney, spark points connected with the conductors and above the gas burner, and earthenware tubes within the chimney and surrounding the electric conductors so as to insulate them from the metallic chimney and protect them.

627,106. Apparatus for Electrically Lighting Lamps. Henry C. Farquharson, New York, N. Y. Application filed December 8, 1898.

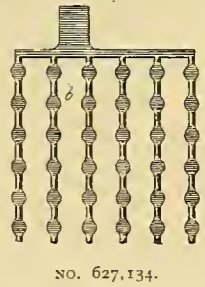
The spark-point holder has holes through it and spark-point wires in the holes and clamping devices for the spark wires, a spider having an opening through which the spark-point holder passes, and arms variable in length and adapted to rest upon and be supported by the lamp chimney.

627,133. Electric Vehicle. William M. McDougall, East Orange, N. J. Application filed August 4, 1898.

In an electrically propelled vehicle there is the combination of a plurality of gear wheels, an electric motor and its shaft, a system of levers by which the shaft is moved to engage with one or the other of the gears, a pole-changing switch controlling current to the motor and connected with the system of levers, and means for manually moving the system of levers.

627,134. Secondary Battery. William M. McDougall, East Orange, N. J. Application filed August 4, 1898.

A plate consisting of a case of non-conducting material having cells therein, a conducting portion confined within the case, portions of which are exposed in the cells, the exposed portions having enlarged surfaces.



NO. 627,134.

627,144. Electric Transformer. Gustave A. Scheffer, Peoria, Ill. Application filed January 11, 1899.

A magnetic core has sides angularly placed with relation to each other, the sides uniting to form an angular corner, recesses being provided in the corner angularly disposed with relation to the sides, whereby ventilation may be secured without impairing the magnetic density.

627,155. Electrostatic Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed April 18, 1898.

The improvement described in the art of making electric measurements consists in inclosing the instrument by which the measurements are effected in a practically non-striking vacuum.

627,172. Telephone Toll Apparatus. John T. Belanger, Detroit, Mich. Application filed April 3, 1899.

In a telephone-toll apparatus the combination of the telephone circuit, the signaling circuit including a movable contact, a circuit bridged onto the telephone circuit independent of the signaling circuit and containing an electromagnet adapted to actuate the movable contact of the signaling circuit and means for energizing the electromagnet.

627,242. Electric Relay. Herbert B. Taylor, Newark, N. J. Application filed August 27, 1898.

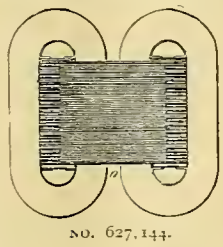
A relay having its armature provided with a carbon and a metal contact co-operating respectively with corresponding contacts of carbon and metal, one carbon contact having a concave and the other a convex-engaging face, one of them being yieldingly mounted.

627,243. Railway Signal. Herbert B. Taylor, Newark, N. J. Application filed October 15, 1898.

A railway-signal system comprising a plurality of blocks or sections, signal stations located at or near the junction of the blocks, track relays guarding the forward and rear blocks, respectively, an electric motor for operating the signals and a current-reversing apparatus for the motor operated by the relays.

627,245. Railway Signal. James Wayland, Newark, N. J. Application filed July 13, 1898.

A railway-signal system comprising a plurality of track sections and corresponding signal stations, an electromagnetic circuit breaker in a signal-operating circuit controlled by a rail circuit at one side of the signal station, the circuit breaker being provided with elastically mounted multiple contacts of carbon and metal, and adjusting device for making the final rupture occur between the carbon surfaces, and an auxiliary circuit breaker in the signal-operating circuit controlled by a magnet connected in a track circuit at the other side of the signal.



NO. 627,144.

627,246. Generating Electricity for Cars, etc. James Wayland, Newark, N. J. Application filed July 26, 1898.

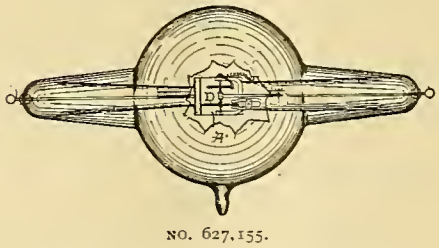
The combination consists of a railway car, a dynamo-electric generator and a flanged collar co-operating with a reversing switch for changing the circuits of the generator with relation to the car circuits, the collar being provided with a pin projecting into an inclined slot formed in a shaft driven by the car.

627,252. Means for Lubricating Electric Motors. Niels A. Christensen, Milwaukee, Wis. Application filed March 8, 1899.

In an electric motor the combination with an armature bearing of a lubricating device comprising an oil well, means for conveying oil from the well to the bearing, means for replenishing the well with oil, and an overflow passage leading out of the well above the bottom thereof at a level above which it is desired that the oil shall not rise therein.

627,266. Process of Producing Acid Chromate of Lead. Carl Luckow, Cologne-Deutz, Germany. Application filed December 31, 1897.

The process described consists of producing acid chromate of lead by means of electrolysis by using in connection with an anode of lead an aqueous solution as electrolyte containing from 0.3 to 3 per cent. of the sodium, potassium or ammonium salts of chloric acid in mixture with the sodium, potassium or ammonium salts of chromic acid, passing the current and maintaining the bath constant by the continuous addition of water and chromic acid.



NO. 627,155.

627,267. Process of Producing Basic Phosphate of Copper by Means of Electrolysis. Carl Luckow, Cologne-Deutz, Germany. Application filed December 31, 1897.

The process is described of producing basic phosphate of copper by means of electrolysis by using with anodes of copper an aqueous solution as electrolyte containing from 0.3 to 3 per cent. of the sodium, potassium or ammonium salts of chloric acid in mixture with the sodium, potassium or ammonium salts of phosphoric acid, passing the current and maintaining the bath constant by the continuous addition of water and phosphoric acid and air.

627,291. Driving Mechanism for Dynamos on Car Trucks. William L. Bliss, New York, N. Y. Application filed March 2, 1898.

This arrangement includes a truck frame, an axle, a hollow shaft mounted to rotate in the truck frame, the hollow shaft surrounding and spaced from the axle, and a flexible driving connection between the axle and hollow shaft.

627,322. Thermostatic Instrument. Charles Burgher, Winthrop, Mass. Application filed June 7, 1898.

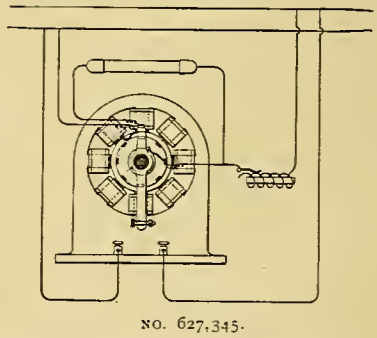
The device includes a base, circuit terminals secured thereto on substantially diametrically opposite sides and provided with co-operating overlapping arms separated to leave an opening, a weight to render the co-operating arms active, provided with a stem extended through the opening, and fusible means to restrain the weight from contact with the circuit terminals until released by heat.

627,326. Electric-lighting System for Cars. John L. Creveling, New York, N. Y. Application filed April 10, 1899.

The dynamo armature is driven from a reversible source of motion and a rotating member subject to reversal with the source of motion, with a pole-changing switch operated by frictional contact with the rotating member, and electromagnetic means for breaking the frictional contact.

627,345. Generating Electric Waves or Vibrations. Daniel M. Moore, Newark, N. J. Application filed November 16, 1896.

The improvement described in generating electric waves, vibrations or disturbances suitable for producing luminous effects, Roentgen rays and the like, by interrupting a circuit of self-induction carrying a varying current, consists in timing the interruptions to take place at or about the maximum of each wave of the varying current.



NO. 627,345.

627,366. Insulator for Fastening Electric Wires. John Treleaven, Vancouver, Canada. Application filed January 4, 1899.

This insulator has a groove passing approximately half way around near its top, another groove on the opposite side curved downward and intersecting the opposite ends of the first groove, the intersections being angling obliquely to the plane of the first groove, and means for preventing the insulator from turning when fastened.

627,376. Controller. Thorsten von Zweigbergk, Cleveland, O. Application filed February 27, 1899.

The combination of a governing cylinder, a reversing cylinder, a pair of operating handles, one for each cylinder, and a braking handle adapted to operate both of the cylinders without disturbing their handles.

627,417. Electric Motor. Alfred Hinman, Forest City, Mo. Application filed January 4, 1898. Renewed May 22, 1899.

One feature is the armature comprising a frame consisting of flanged end pieces, cores for the magnets having their ends bearing on the flanges, and screws passing between adjacent cores and engaging in tapped holes in the flanges.

627,442. Process of Electrolytically Treating Ores. Louis Pelatan, Paris, France. Application filed October 21, 1897.

The improvement in processes of treating ores electrolytically consisting in adding to a sludge, consisting of ore and water, a solvent and picric acid as an oxidizing agent and then passing an electric current therethrough.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, JULY 8, 1899. No. 2

Switchboard at United States Proving Grounds, Indian Head.

The electrical plant at the United States Government Proving Grounds, Indian Head, consists of two alternating - current - direct - current Westinghouse generators (Fig. 1), "engine type," of 250 kilowatts each, and one of 75 kilowatts, alternating-current, each machine driven by its own engine. The engines are two 20 by 34 by 16, 500 horse power each, and one compound 12 and 20 by 12, 150 horse power. Each of the 250-kilowatt generators delivers current simultaneously from both sides; from one, direct-current at 550 volts, and from the other, two-phase alternating current at 400 volts, 3,600 alternations. The 75-kilowatt generator delivers two-phase alternating-current of the same voltage and frequency as the alternating-current side of the larger generators. Each of the 250-kilowatt generators has an exciter, 7½ kilowatts, driven from the engine to which the main generator is directly connected. The 75-kilowatt generator has an exciter, 1.87 kilowatts. In the generating station is an 18¾-kilowatt transformer, for stepping-up the alternating current to 1,100 volts, to supply a feeder-line for lighting buildings adjacent to the proving grounds.

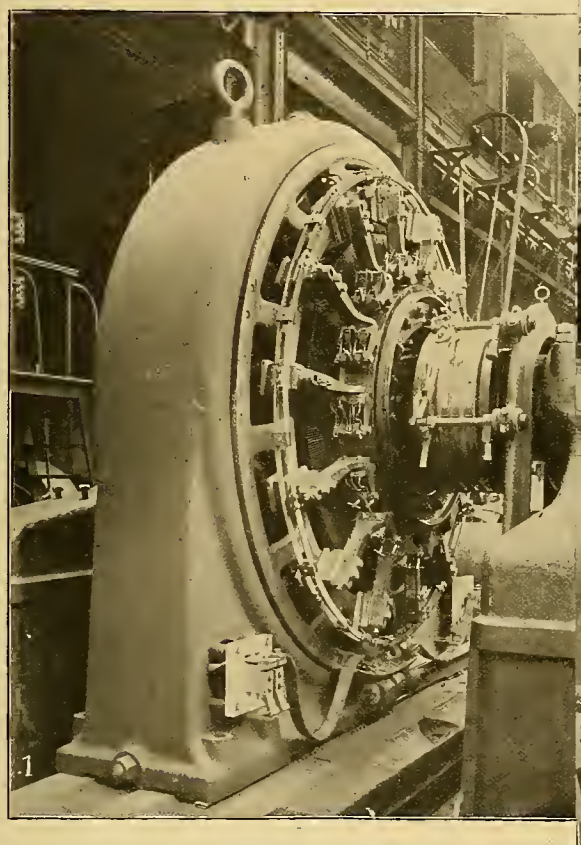


Fig. 1. Westinghouse Alternating-current-direct-current 250 Kilowatt Generator.

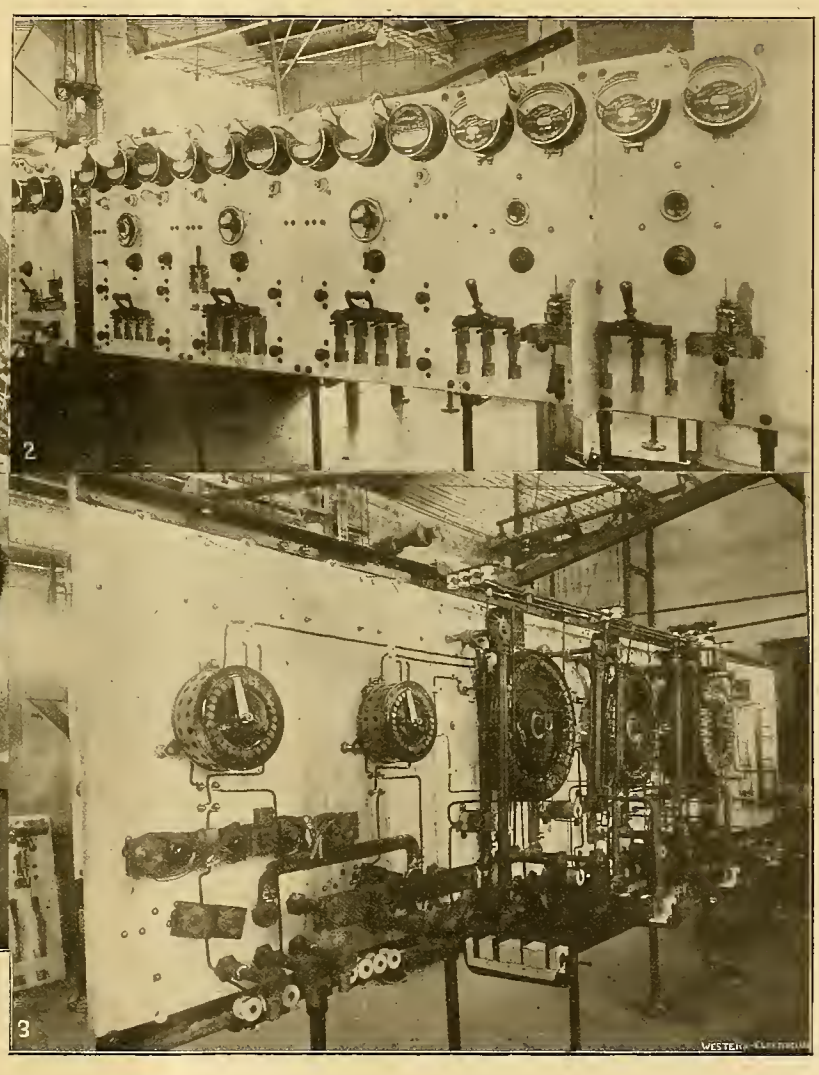


Fig. 2. Front View of Switchboard
Fig. 3. Rear View of Switchboard.

SWITCHBOARD AT UNITED STATES PROVING GROUNDS, INDIAN HEAD.

The generators provide alternating current for several Westinghouse type "C" induction motors, driving machinery in the powder mills; also direct current for an electric-railway system, operated partly by overhead trolley and partly by the Westinghouse surface-contact system, and for a crane motor in the proving grounds. Alternating current is also provided for lighting the various mills, offices and houses. The 75-kilowatt generator runs in parallel with the alternating-current side of the 250-kilowatt machines, and these latter machines are run in parallel on their direct-current ends. Any or all of the generator fields may be fed from either or both of the 7½-kilowatt exciters, which can run separately or in multiple. The 1.87 kilowatt exciter can only be used for exciting the 75-kilowatt generator, which is entirely separately excited.

The alternating-current-direct-current generators are provided with series fields as well as separately excited fields. These series fields are just sufficient to compensate for the drop caused by their direct-current, and do not interfere with running the 250-kilowatt and the 75-kilowatt machines in parallel. Fig. 4 shows the armature of 250-kilowatt generator.

The switchboard consists of five panels, one for the direct-current side of each of the 250-kilowatt generators, and one for the alternating-current side of each of the same, and one panel for the 75-kilowatt alternating-current generator. Figs. 2 and 3 give front and rear views of the switchboard.

The 75-kilowatt generator panel has 200-ampere alternating-current ammeters, one in each phase; one 600-volt alternating-current voltmeter, with voltmeter plug and receptacle, so that the voltmeter can be thrown on either of the two phases; also a combination rheostat with two concentric hand-wheels on the front, to control the 75-kilowatt generator and its exciter. There are four field plugs, three connected to the positive sides of the three exciters and the fourth to the negative side of the field, so that the generator field may be connected to any one or all three of the exciters. Also, there is a four-pole single-throw quick-break watsher switch for main circuit of generator. Each of the two panels controlling the alternating-current ends of the 250-kilowatt generators has the following instruments: Two 600-ampere alternating-current ammeters, one in each phase, one 600-volt alternating-current voltmeter, with voltmeter plug and receptacle, so that the voltmeter can be thrown on either of the two phases, a rheostat to control the field current, field plugs connected to the positive and negative sides of the 7½-kilowatt exciters, a four-pole single-throw quick-break washer switch for main current of generator; also, on one of the panels, a two-pole double-throw quick-break washer switch for connecting the 18¾-kilowatt 400-1,100-volt step-up transformer to either phase. This 1,100-volt circuit, in connection with step-down transformers, is used for furnishing current to 222 16 candle power incandescent lamps about the grounds.

Each of the panels for the direct-current side of the 250-kilowatt generators is furnished with the following devices: An 800-ampere direct-current ammeter, a 600-volt direct-current voltmeter with plug and receptacle, a 600-ampere single-pole circuit breaker, a three-pole single-throw quick-break washer switch in main circuit of direct-current side of generator, one rheostat to control the field current of one of the 7½-kilowatt exciters.

Arrangements have been made, enabling the alternating-current-direct-current generators to be in multiple with each other at either of their alternating-current or direct-current sides, or that either of them shall run in multiple with the 75-alternating-current generator when necessary. The latter may be used as auxiliary to either of the 250-kilowatt generators in supplying power to the powder mills, or may be used alone for light loads in supplying either light or power, or both. One of the large generators, aided by the 75-kilowatt generator, will be able to carry the ordinary demands upon the plant, without the second large generator, the two having sufficient capacity to run the stationary motors and one locomotive; or if the load of the stationary motors be too large, then some of these can be cut off, enabling the more important work to be carried on without serious interruption.

The electrical plant was installed by the Westinghouse Electric and Manufacturing company, and the engines were furnished by Westinghouse, Church, Kerr & Co. of New York.

Automatic Repeater for Wireless Telegraphy Suggested.

Mr. S. P. Kingston of Jackson, Mich., is a practical telegrapher who has followed the experiments in "wireless" telegraphy with much interest. He sends the Western Electrician the sketch which is reproduced on the next page with this explanation:

"Inclosed find a rough sketch of what might be called a 'wireless-telegraph automatic repeater.' I understand that wireless telegraphy is practical up to a certain limit, or, until the curvature of the earth interferes with the ethereal waves or oscillations. The idea of having an automatic repeater or repeaters seems to have been entirely overlooked. If such a repeater could be made practicable, it could be easily placed in a weatherproof box at the foot of a pole or on the top of a high building. These repeaters could be placed at regular intervals of, say, 20 or 25 miles apart. One might say that the signals received on the receiving side of the repeater would interfere with the sending side. But I understand that these waves can be sent in a certain direction by using a metal reflector. Why, then, could we not use a shield of similar metal to protect the sending side of the repeater from the receiving side.

"Referring to the sketch, (A) is the sending station, (B) the repeater station, (C) receiving station, (D) (D) are batteries, (E) (E) induction coils, (F) (F) ground connections, (G) is the telegraph key at the sending station, (H) is the coherer of the wireless-telegraph repeater, (I) is a relay connected to repeat the signals, (J) is a repeating sounder and (K) is a metal shield or reflector to separate the receiving and sending sides of the repeater."

The possibility is a very interesting one. Mr. Kingston says that he has not time to make actual experiment of the practicability of automatic repeaters for space telegraphers, but he makes the suggestion for what it is worth.

Regulations for Automobilists Proposed.

City Electrician Ellicott has drafted the points he thinks should be incorporated in the ordinance to license automobiles in Chicago, and sent his suggestions to Corporation Counsel Walker, who is drawing up the ordinance. The suggestions he makes are:

A license should be issued to the operator upon examination by a board, covering his physical condition, mental balance, reasonable knowledge of mechanical appliances and his familiarity with the parts of the apparatus liable to become deranged.

The cost of the license should not exceed 25 cents and should be required to be renewed annually.

Accidents caused clearly through carelessness of operators of these vehicles should be sufficient reason for revocation of license.

Operators of the vehicles of the character described without a license should be punishable by a fine of not less than $5 or more than $25 for each offense.

The speed of vehicles should not exceed eight miles an hour.

Such vehicles should be provided with a four-inch, mechanically operated bell and approved brakes should be provided for stopping vehicles.

The examining board might consist of the commissioner of public works, commissioner of health and the city engineer or the city electrician, a secretary for keeping records of the office, and should make provisions for examinations to be held twice each month.

The board should be given the authority to revoke licenses for violation of the ordinance on proof of carelessness or inability of the operators.

Telediagraphy is a new word applied to the art of electrically transmitting pictures or drawings at a distance.

Standardization of Electrical Apparatus.

One of the most important tasks ever undertaken by the American Institute of Electrical Engineers was the endeavor to formulate a plan of standardizing electrical methods and electrical apparatus. The committee to which this arduous work was committed has already spent 15 months on the task, submitting a preliminary report at the Omaha meeting of last year and a revised report in Boston on June 26th of this year. The committee consists of Francis B. Crocker, chairman; Cary T. Hutchinson, A. E. Kennelly, J. W. Lieb, Jr., Charles P. Steinmetz, Lewis B. Stillwell and Elihu Thomson.

In submitting the revised report the committee says: "Your committee on standardization begs to submit the following report, covering such subjects as have been deemed of pressing and immediate importance, and which are of such a nature that general agreement may be expected upon them. While it is the opinion of the committee that many other matters might advantageously have been considered, as, for example, standard methods of testing, yet it has been deemed inexpedient to attempt to cover in a single report more than is here submitted."

The full text of the revised report is as follows:

General Plan.

Efficiency. Sections 1 to 24.
- (I) Commutating machines Secs. 6 to 9
- (II) Synchronous machines. Secs 10 to 11
- (III) Synchronous commutating machines. Secs. 12 to 15

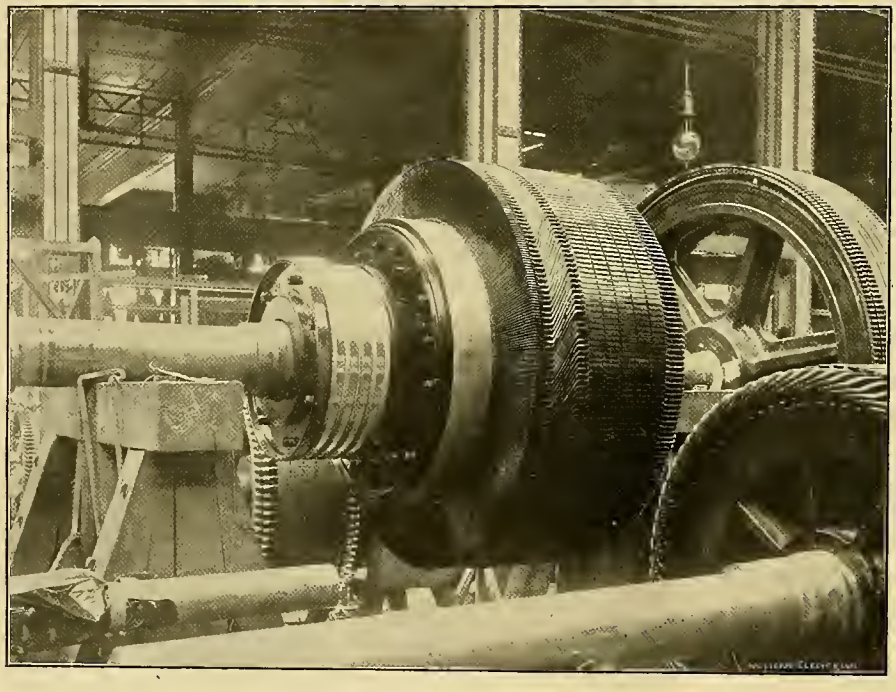


FIG. 4. SWITCHBOARD AT UNITED STATES PROVING GROUNDS, INDIAN HEAD.—WESTINGHOUSE ALTERNATING CURRENT-DIRECT-CURRENT 250 KILOWATT GENERATOR-ARMATURE.

- (IV) Rectifying machines, Secs. 16 to 17
- (V) Stationary induction apparatus. Secs. 18 to 19
- (VI) Rotary induction apparatus. Secs. 20 to 23
- (VII) Transmission lines Sec. 24

Rise of Temperature. Sections 25 to 31.
Insulation. Sections 32 to 41.
Regulation. Sections 42 to 61.
Variation and Pulsation. Sections 62 to 65.
Rating. Sections 66 to 73.
Classification of Voltages and Frequencies. Sections 74 to 78.
Overload Capacities. Sections 79 to 82.
Appendices.
- (I) Efficiency.
- (II) Apparent efficiency.
- (III) Power factor and inductance factor.
- (IV) Notation.
- (V) Table of sparking distances.

Electrical apparatus will be treated under the following heads:

I. *Commutating Machines,* which comprise a constant magnetic field, a closed-coil armature and a multi-segmental commutator connected thereto.

Under this head may be classed the following: Direct-current generators, direct-current motors, direct-current boosters, motor-generators, dynamotors, converters and closed-coil arc machines.

A booster is a machine inserted in series in a circuit to change its voltage, and may be driven either by an electric motor, or otherwise. In the former case it is a motor-booster.

A motor-generator is a transforming device consisting of two machines, a motor and a generator, mechanically connected together.

A dynamotor is a transforming device combining both motor and generator action in one magnetic field, with two armatures or with an armature having two separate windings.

For converters, see III.

II. *Synchronous Machines,* which comprise a constant magnetic field, and an armature receiving or delivering alternating currents in synchronism with the motion of the machine, i. e., having a frequency equal to the product of the number of pairs of poles and the speed of the machine in revolutions per second.

III. *Synchronous Commutating Machines.*—These include: 1. Synchronous converters, i. e., converters from alternating to direct, or from direct to alternating current, and 2, double-current generators, i. e., generators producing both direct and alternating currents.

A converter is a rotary device transforming electric energy from one form into another without passing it through the intermediary form of mechanical energy.

A converter may be either:

a. A direct-current converter, converting from a direct current to a direct current, or,

b. A synchronous converter, formerly called a rotary converter, converting from an alternating to a direct current, or vice versa.

Phase converters are converters from an alternating-current system to an alternating-current system of the same frequency, but different phase.

Frequency converters are converters from an alternating-current system of one frequency to an alternating-current system of another frequency, with or without changes of phase.

IV. *Rectifying Machines, or Pulsating-current Generators,* which produce a unidirectional current of periodically varying strength.

V. *Stationary Induction Apparatus,* i. e., stationary apparatus changing electric energy from one form into another, without passing it through an intermediary form of energy. These comprise:

a. Transformers, or stationary induction apparatus in which the primary and secondary windings are electrically insulated from each other.

b. Auto-transformers, formerly called compensators; i. e., stationary induction apparatus in which part of the primary winding is used as a secondary winding; or conversely.

c. Potential regulators, or stationary induction apparatus having a coil in shunt, and a coil in series with the circuit, so arranged that the ratio of transformation between them is variable at will.

These may be divided into:

1. Compensator potential regulators, in which the number of turns of one of the coils is changed.

2. Induction potential regulators, in which the relative positions of primary and secondary coils are changed.

3. Magneto-potential regulators, in which the direction of the magnetic flux with respect to the coils is changed.

d. Reactive coils, or reactance coils, formerly called choking coils; i. e., stationary inductance apparatus, used to produce impedance or phase displacement.

VI. *Rotary Induction Apparatus,* which consist of primary and secondary windings, rotating with respect to each other. They comprise:

a. Induction motors.
b. Induction generators.
c. Frequency changers.
d. Rotary-phase converters.

Efficiency.

1. The "efficiency" of an apparatus is the ratio of its net power output to its gross power input.[1]

2. Electric power should be measured at the terminals of the apparatus.

3. In determining the efficiency of alternating-current apparatus, the electric power should be measured when the current is in phase with the electromotive force, unless otherwise specified, except when a definite phase difference is inherent in the apparatus, as in induction motors, etc.

4. Mechanical power in machines should be measured at the pulley, gearing, coupling, etc., thus excluding the loss of power in said pulley, gearing or coupling, but including the bearing friction and windage. The magnitude of bearing friction and windage may be considered as independent of the load. The loss of power in the belt and the increase of bearing friction due to belt tension should be excluded. Where, however, a machine is mounted upon the shaft of a prime-mover, in such a manner that it cannot be separated therefrom, the frictional losses in bearings and in windage, which ought, by definition, to be included in determining the efficiency, should be excluded, owing to the practical impossibility of determining them satisfactorily. The brush friction, however, should be included.

a. Where a machine has auxiliary apparatus, such as an exciter, the power lost in the auxiliary apparatus should not be charged to the machine, but to the plant consisting of machine and auxiliary apparatus taken together. The plant efficiency in such cases should be distinguished from the machine efficiency.

5. The efficiency may be determined by measuring all the losses individually and adding their sum to the output to derive the input, or subtracting their sum from the input to derive the output. All losses should be measured at, or reduced to, the temperature assumed in continuous operation, or in

1. An exception should be noted in the case of storage batteries or apparatus for storing energy, in which the efficiency, unless otherwise qualified, should be understood as the ratio of the energy output to the energy intake in a normal cycle.

operation under conditions specified. (See Sections 25 to 31.)

In order to consider the application of the foregoing rules to various machines in general use, the latter may be conveniently divided into classes, as follows:

I. *Commutating Machines.*

6. In commutating machines the losses are:

a. Bearing friction and windage. (See Section 4.)

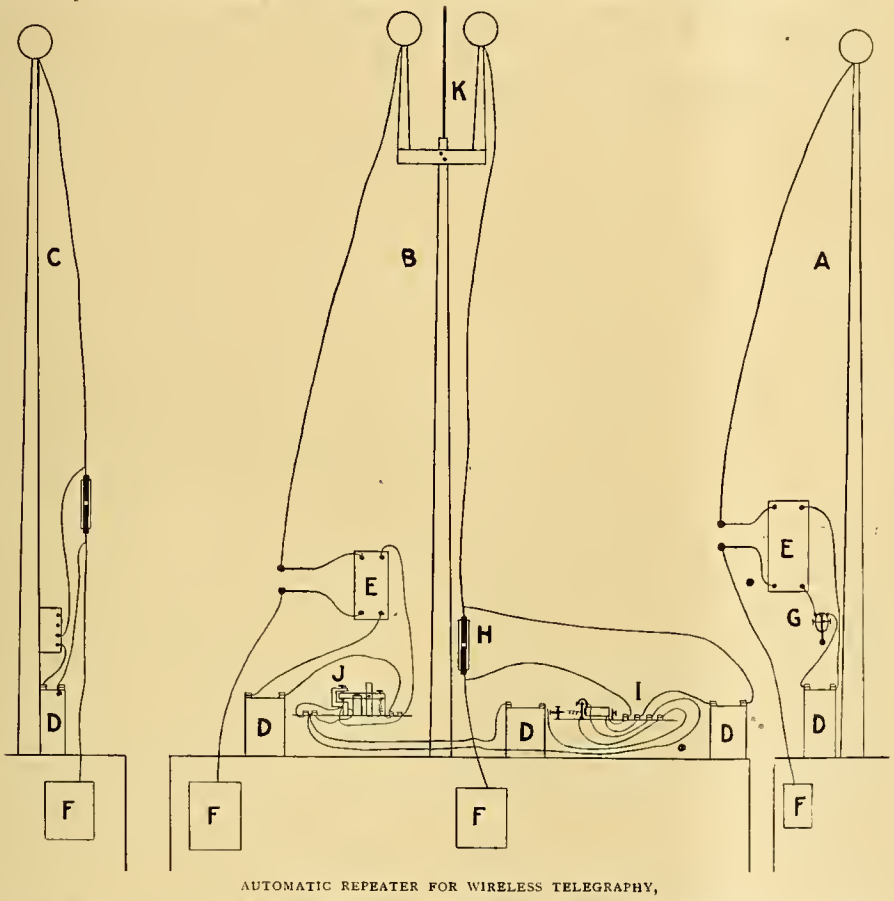
b. Molecular magnetic friction and eddy currents in iron and copper. These losses should be determined with the machine on open circuit, and at a voltage equal to the rated voltage $+ I r$ in a generator, and $- I r$ in a motor, where I denotes the current strength and r denotes the internal resistance of the machine. They should be measured at the correct speed and voltage, since they do not usually vary in proportion to the speed, or to any definite power of the voltage.

c. Armature resistance losses, $I^2 r'$, where I is the current strength in the armature, and r' is the resistance between armature brushes, excluding the resistance of brushes and brush contacts.

d. Commutator brush friction.

e. Commutator brush-contact resistance. It is desirable to point out that with carbon brushes the losses (*d*) and (*e*) are usually considerable in low-voltage machines.

f. Field excitation. With separately excited fields, the loss of power in the resistance of the field coils



AUTOMATIC REPEATER FOR WIRELESS TELEGRAPHY,

alone should be considered. With shunt fields or series fields, however, the loss of power in the accompanying rheostat should also be included, the said rheostat being considered as an essential part of the machine, and not as separate auxiliary apparatus.

(*b*) (*c*) are losses in the armature or "armature losses:" (*d*) and (*e*) "commutator losses;" (*f*) "field losses."

7. The difference between the total losses under load and the sum of the losses above specified should be considered as "load losses," and are usually trivial in commutating machines of small field distortion. When the field distortion is large, as is shown by the necessity for shifting the brushes between no load and full load, or with variations of load, these load losses may be considerable, and should be taken into account. In this case the efficiency may be determined either by input and output measurements, or the load losses may be estimated by the method of Section II.

8. Boosters should be considered and treated like other direct-current machines in regard to losses.

9. In motor-generators, dynamotors or converters, the efficiency is the $\frac{\text{electric output}}{\text{electric input}}$.

II. *Synchronous Machines.*

10. In synchronous machines the output or input should be measured with the current in phase with the terminal electromotive force, except when otherwise expressly specified.

Owing to the uncertainty necessarily involved in the approximation of load losses, it is preferable, whenever possible, to determine the efficiency of synchronous machines by input and output tests.

11. The losses in synchronous machines are:

a. Bearing friction and windage. (See Section 4.)

b. Molecular magnetic friction and eddy currents in iron, copper and other metallic parts. These losses should be determined at open circuit of the machine at the rated speed and at the rated voltage, $+ I r$ in a synchronous generator, $- I r$ in a synchronous motor, where $I =$ current in armature, $r =$ armature resistance. It is undesirable to compute these losses from observations made at other speeds or voltages.

These losses may be determined either by driving the machine by a motor, or by running it as a synchronous motor, and adjusting its fields so as to get minimum current input and measuring the input by wattmeter. The former is the preferable method, and in polyphase machines the latter method is liable to give erroneous results in consequence of unequal distribution of currents in the different circuits, caused by inequalities of the impedance of connecting leads, etc.

c. Armature-resistance loss, which may be expressed by $p I^2 r$; where $r =$ resistance of one armature circuit or branch, $I =$ the current in such armature circuit or branch, and $p =$ the number of armature circuits or branches.

d. Load losses as defined in Section 7. While these losses cannot well be determined individually, they may be considerable and, therefore, their joint influence should be determined by observation. This can be done by operating the machine on short-circuit and at full-load current; that is by determining what may be called the "short-circuit core loss." With the low-field intensity and the great lag of current existing in this case, the load losses are usually greatly exaggerated.

One-third of the short-circuit core loss may, as an approximation, and in the absence of more accurate information, be assumed as the load loss.

e. Collector-ring friction and contact resistance. These are generally negligible, except in machines of extremely low voltage.

f. Field excitation. In separately excited machines, the $I^2 r$ of the field coils proper should be used. In self-exciting machines, however, the loss in the field rheostat should be included. (See Section 6 *f.*)

III. *Synchronous Commutating Machines.*

12. In synchronous converters, the power on the alternating-current side is to be measured with the current in phase with the terminal electromotive force, unless otherwise specified.

13. In double-current generators, the efficiency of the machine should be determined as a direct-current generator in accordance with Section 6, and as an alternating-current generator in accordance with Section 11. The two values of efficiency may be different, and should be clearly distinguished.

14. In synchronous converters, the losses should be determined when driving the machine by a motor. These losses are:

a. Bearing friction and windage. (See Section 4.)

b. Molecular magnetic friction and eddy currents in iron, copper and metallic parts. These losses should be determined at open circuit and at the rated terminal voltage, no allowance being made for the armature resistance, since the alternating and the direct currents flow in opposite directions.

c. Armature resistance. The loss in the armature is $q I^2 r$, where $I =$ direct current in armature, $r =$ armature resistance and q, a factor which is equal to 1.37 in single-phasers, 0.56 in three-phasers, 0.37 in quarter-phasers and 0.26 in six-phasers.

d. Load losses. The load losses should be determined in the same manner as described in Section 11 *d*, with reference to the direct-current side.

e and *f.* Losses in commutator and collector friction and brush-contact resistance. (See Sections 6 and 11.)

g. Field excitation. In separately excited fields, the $I^2 r$ loss in the field coils proper should be taken, while in shunt and series fields the rheostat loss should be included, except where fields and rheostats are intentionally modified to produce effects outside of the conversion of electric power, as for producing phase displacement for voltage control. In this case 25 per cent. of the $I^2 r$ loss in the field proper at non-inductive alternating circuit should be added as proper estimated allowance for normal rheostat losses. (See Section 6 *f.*)

15. Where two similar synchronous machines are available, their efficiency can be determined by operating one machine as a converter from direct to alternating, and the other as a converter from alternating to direct, connecting the alternating sides together, and measuring the difference between the direct-current input and the direct-current output. This process may be modified by returning the output of the second machine through two boosters into the first machine and measuring the losses. Another modification might be to supply the losses by an alternator between the two machines, using potential regulators.

IV. *Rectifying Machines or Pulsating-current Generators.*

16. These include: Open-coil arc machines, constant-current rectifiers, constant-potential rectifiers.

The losses in open-coil arc machines are essentially the same as in Sections 6 to 9 (closed-coil commutating machines). In alternating-current rectifiers, however, the output must be measured by wattmeter and not by voltmeter and ammeter, since, owing to the pulsation of current and electromotive force, a considerable discrepancy may exist between watts and volt-amperes, amounting to as much as 10 or 15 per cent.

17. In constant-current rectifiers, transforming from constant-potential alternating to constant direct current by means of constant-current transformers and rectifying commutators, the losses in the transformers are to be included in the efficiency and have to be measured when operating the rectifier, since in this case the losses are generally greater than when feeding an alternating secondary circuit. In constant-current transformers the load losses are usually larger than in constant-potential transformers, and thus should not be neglected.

The most satisfactory method of determining the efficiency in rectifiers is to measure electric input and electric output by wattmeter. The input is usually not non-inductive, owing to a considerable phase displacement and to wave distortion. For this reason the apparent efficiency should also be considered, since it is usually much lower than the true efficiency. The power consumed by the synchronous motor or other source driving the rectifier should be included in the electric input.

V. *Stationary Induction Apparatus.*

18. Since the efficiency of induction apparatus depends upon the wave shape of electromotive force, it should be referred to a sine wave of electromotive force, except where expressly specified otherwise. The efficiency should be measured with non-inductive load, and at rated frequency, except where expressly specified otherwise. The losses are:

a. Molecular magnetic friction and eddy currents measured at open circuit and at rated voltage $- Ir$, where $I =$ rated current, $r =$ resistance of primary circuit.

b. Resistance losses, the sum of the $I^2 r$ of primary and of secondary in a transformer, or of the two sections of the coil in the compensator or auto-transformer, where $I =$ current in the coil or section of coil, $r =$ resistance.

c. Load losses, i. e., eddy currents in the iron, and especially in the copper conductors, caused by the current. They should be measured by short-circuiting the secondary of the transformer and impressing upon the primary an electromotve force sufficient to send full-load current through the transformer. The loss in the transformer under these conditions measured by wattmeter gives the load losses $+ I^2 r$ losses in both primary and secondary coils.

d. Losses due to the methods of cooling, as power consumed by the blower in air-blast transformers, and power consumed by the motor driving pumps in oil or water-cooled transformers. Where the same cooling apparatus supplies a number of transformers or is installed to supply future additions, allowance should be made therefor.

19. In potential regulators the efficiency should be taken at the maximum voltage for which the apparatus is designed, and with non-inductive load, unless otherwise specified.

VI. *Rotary Induction Apparatus.*

20. Owing to the existence of load losses and since the magnetic density in the induction motor under load changes in a complex manner, the efficiency should be determined by measuring the electric input by wattmeter and the mechanical output at the pulley, gear, coupling, etc.

21. The efficiency should be determined at the rated frequency and the input measured with sine waves of impressed electromotive force.

22. The efficiency may be calculated from the apparent input, the power factor and the power output. The same applies to induction generators. Since phase displacement is inherent in induction machines, their apparent efficiency is also important.

23. In frequency changers, i. e., apparatus transforming from a polyphase system to an alternating system of different frequency, with or without a change in the number of phases, and phase converters, i. e., apparatus converting from an alternating system, usually single-phase, to another alternating system, usually polyphase, of the same frequency, the efficiency should also be determined by measuring both output and input.

VII. *Transmission Lines.*

24. The efficiency of transmission lines should be measured with non-inductive load at the receiving end, with the rated receiving pressure and frequency, also with sinusoidal impressed electromotive forces, except where expressly specified otherwise, and with the exclusion of transformers or other apparatus at the ends of the line.

Rise of Temperature.

General Principles.

25. Under regular service conditions, the temperature of electrical machinery should never be allowed to remain at a point at which permanent deterioration of its insulating material takes place.

26. The rise of temperature should be referred to the standard conditions of a room-temperature of 25° C., a barometric pressure of 760 millimeters and normal conditions of ventilation; that is, the apparatus under test should neither be exposed to draught, nor enclosed, except where expressly specified.

27. If the room temperature during the test differs from 25° C., the observed rise of temperature should be corrected by one-half per cent. for each degree C.[1] Thus with a room temperature of 35° C., the observed rise of temperature has to be decreased by five per cent., and with a room temperature of 15° C., the observed rise of temperature has to be increased by five per cent. The thermometer indicating the room temperature should be screened from thermal radiation emitted by heated bodies, or from draughts of air. When it is impracticable to secure normal conditions of ventilation on account of an adjacent engine, or other sources of heat, the thermometer for measuring the air temperature should be placed so as fairly to indicate the temperature which the machine would have if it were idle, in order that the rise of temperature determined shall be that caused by the operation of the machine.

28. The temperature should be measured after a run of sufficient duration to reach practical constancy. This is usually from six to 18 hours, according to the size and construction of the apparatus. It is permissible, however, to shorten the time of the test by running a lesser time on an overload in current and voltage, then reducing the load to normal, and maintaining it thus until the temperature has become constant.

In apparatus intended for intermittent service, as railway motors, starting rheostats, etc., the rise of temperature should be measured after a shorter time, depending upon the nature of the service, and should be specified.

In apparatus which by the nature of their service may be exposed to overload, as railway converters, and in very high-voltage circuits, a smaller rise of temperature should be specified than in apparatus not liable to overloads or in low-voltage apparatus. In apparatus built for conditions of limited space, as railway motors, a higher rise of temperature must be allowed.

1. This correction is also intended to compensate, as nearly as is at present practicable, for the error involved in the assumption of a constant temperature coefficient of resistivity; i. e., 0.4 per cent. per degree C., taken with varying initial temperatures.

29. In electrical conductors, the rise of temperature should be determined by their increase of resistance. For this purpose the resistance may be measured either by galvanometer test or by drop-of-potential method. A temperature coefficient of 0.4 per cent. per degree C. may be assumed for copper.[1] Temperature elevations measured in this way are usually in excess of temperature elevations measured by thermometers.

30. It is recommended that the following maximum values of temperature elevation should not be exceeded:

Commutating machines, rectifying machines and synchronous machines:
- Field and armature, by resistance, 50° C.
- Commutator and collector rings and brushes, by thermometer, 55° C.
- Bearings and other parts of machine, by thermometer, 40° C.

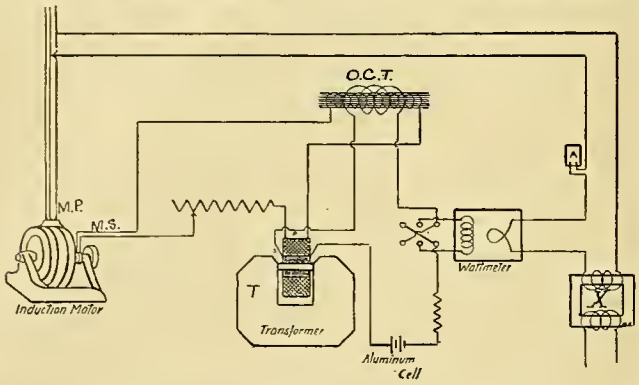
Rotary induction apparatus:
- Electric circuits, 50° C., by resistance.
- Bearings and other parts of the machine 40° C., by thermometer.

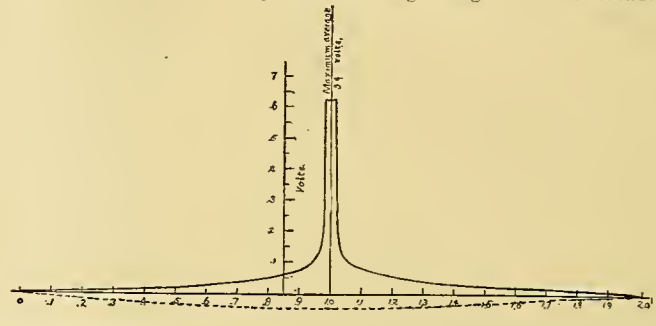
In squirrel-cage or short-circuited armatures, 55° C., by thermometer, may be allowed.

Transformers for continuous service—electric circuits by resistance, 50° C., other parts by thermometer, 40° C., under conditions of normal ventilation.

Reactive coils, induction and magneto regulators—electric circuits by resistance 55° C., other parts by thermometer 45° C.

Where a thermometer, applied to a coil or winding, indicates a higher temperature elevation than that shown by resistance measurement, the thermometer indication should be accepted. In using the thermometer, care should be taken so to protect its bulb as to prevent radiation from it, and, at the same time, not to interfere seriously with the normal radiation from the part to which it is applied.





FIGS. 1 AND 4. POLYPHASE ELECTRIC TESTING.

31. In the case of apparatus intended for intermittent service, the temperature elevation which is attained at the end of the period corresponding to the term of full load should not exceed 50° C. by resistance in electric circuits. In the case of transformers intended for intermittent service, or not operating continuously at full load, but continuously in circuit, as in the ordinary case of lighting transformers, the temperature elevation above the surrounding air-temperature should not exceed 50° C. by resistance in electric circuits and 40° C. by thermometer in other parts, after the period corresponding to the term of full load. In this instance, the test load should not be applied until the transformer has been in circuit for a sufficient time to attain the temperature elevation due to core loss. With transformers for commercial lighting, the duration of the full-load test may be taken as three hours, unless otherwise specified. In the case of railway, crane and elevator motors, the conditions of service are necessarily so varied that no specific period corresponding to the full-load term can be stated.

Insulation.

32. The ohmic resistance of the insulation is of secondary importance only, as compared with the dielectric strength, or resistance to rupture by high voltage.

Since the ohmic resistance of the insulation can be very greatly increased by baking, but the dielectric strength is liable to be weakened thereby, it is preferable to specify a high dielectric strength rather than a high insulation resistance. The high-voltage test for dielectric strength should always be applied.

Insulation Resistance.

33. Insulation-resistance tests should, if possible, be made at the pressure for which the apparatus is designed.

The insulation resistance of the complete apparatus must be such that the rated voltage of the apparatus will not send more than $\frac{1}{1,000,000}$ of the full load current at the rated terminal voltage through the insulation. Where the value found in this way exceeds one megohm, one megohm is sufficient.

1. By the formula $R_T = R_t\,(1+0.004\,\theta)$. Where R_t is the resistance at room temperature, R_T the resistance when heated, and θ the temperature elevation $(T-t)$ in degrees Centigrade.

Dielectric Strength.

34. The dielectric strength or resistance to rupture should be determined by a continued application of an alternating electromotive force for one minute. The source of alternating electromotive force should be a transformer of such size that the charging current of the apparatus as a condenser does not exceed 25 per cent. of the rated capacity of the transformer.

35. The high-voltage tests should not be applied when the insulation is low, owing to dirt or moisture, and should be applied before the machine is put into commercial service.

36. It should be pointed out that tests at high voltages considerably in excess of the normal voltages are admissible on new machines, to determine whether they fulfill their specifications, but should not be made subsequently at a voltage much exceeding the normal, as the actual insulation of the machine may be weakened by such tests.

37. The test for dielectric strength should be made with the completely assembled apparatus, and not with its individual parts, and the voltage should be applied as follows:

First, between electric circuits and surrounding conducting material, and, second, between adjacent electric circuits, where such exist, as in transformers.

The tests should be made with a sine wave of electromotive force, or, where this is not available, at a voltage giving the same striking distance between needle points in air, as a sine wave of the specified electromotive force, except where expressly specified otherwise. As needles, new sewing needles should be used. It is recommended to shunt the apparatus during the test by a spark gap of needle-points set for a voltage exceeding the required voltage by 10 per cent.

A table of approximate sparking distances is given in Appendix V.

38. The following voltages are recommended for apparatus, not including transmission lines or switchboards:

Rated Terminal Voltage.		Capacity.	Testing Voltage.
Not exceeding 400 volts		Under 10 K. W.	1,000 volts
" " "	" " "	10 K. W. and over	1,500 "
400 and over, but less than 800 volts		Under 10 K. W	1,500 "
400 "	" 800 "	10 K. W. and over	2,000 "
800 "	" 1,200 "	Any	3,500 "
1,200 "	" 2,500 "	Any	5,000 "
2,500 "	"	Any	Double the normal rated voltages.
Synchronous motor fields and fields of converters started from the alternating-current side			5,000 volts

Alternator field circuits should be tested under a breakdown-test voltage corresponding to the rated voltage of the exciter, and referred to an output equal to the output of the alternator; i. e., the exciter should be rated for this test as having an output equal to that of the machine it excites.

Condensers should be tested at twice their rated voltage and at their rated frequency.

The values in the table above are effective values or square roots of mean square reduced to a sine wave of electromotive force.

39. In testing insulation between different electric circuits, as between primary and secondary of transformers, the testing voltage must be chosen corresponding to the high-voltage circuit.

40. In transformers of from 10,000 volts to 20,000 volts, it should be considered as sufficient to operate the transformer at twice its rated voltage, by connecting first the one and then the other terminal of the high-voltage winding to the core and to the low-voltage winding. The test of dielectric resistance between the low-voltage winding and the core should be in accordance with the recommendation in Section 38 for similar voltages and capacities.

41. When machines or apparatus are to be operated in series, so as to employ the sum of their separate electromotive forces, the voltage should be referred to this sum, except where the frames of the machines are separately insulated, both from ground and from each other.

Regulation.

42. The term regulation should have the same meaning as the term "inherent regulation," at present frequently used.

43. The regulation of an apparatus intended for the generation of constant potential, constant current, constant speed, etc., is to be measured by the maximum variation of potential, current, speed, etc., occurring within the range from full load to no load, under such constant conditions of operation as give

[*Continued on page 26.*]

Polyphase Electric Testing.[1]

By Harris J. Ryan.

It is not the object of this paper to take up the general subject of polyphase methods for making electric measurements, but to treat more particularly a method that employs a polyphase source for making instantaneous measurements of alternating currents or pressures without the use of a contact maker.

Description of the Method.—In the diagram of Fig. 1 (T) is a special transformer with a closed magnetic circuit of soft, pure iron or "electrical steel," with the portion enveloped by the primary and secondary coils much restricted in area as compared with the remaining portion of the circuit. The circuit through each sheet is unbroken by joints, making it necessary to wind the secondary and primary by hand after the core forming the magnetic circuit has been built up. The primary coil is so proportioned that sufficient alternating cur-

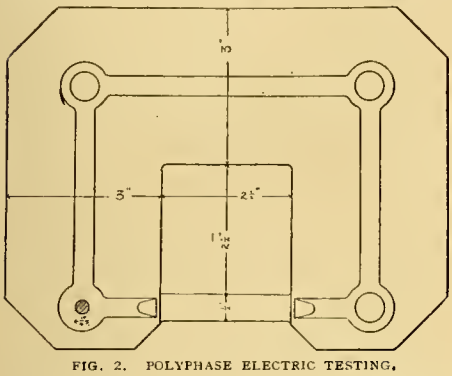


FIG. 2. POLYPHASE ELECTRIC TESTING.

rent may be circulated in it to provide a maximum magnetomotive force of about 500 C. G. S. per centimeter along the core at its restricted portion. Such exciting current may be taken from the secondary of an induction motor appropriated for the purpose or from a set of phase-changing transformers. Under these circumstances the flux through the core of this transformer will cause saturation during 97 per cent. of the time. The greater portion of the reversal of the flux will occur during 1.5 per cent. of the time of one alternation. The greater portion, therefore, of the secondary electromotive-force time integral will occur during 1.5 per cent. of the time of one alternation and at the instant when the exciting current passes through zero. The remaining portion of the secondary time integral of the electromotive force will be applied with symmetry throughout 98.5 per cent. of the alternation, being maximum on either side of zero for the exciting current, and gradually diminishing to zero during the time in which the exciting current is attaining its maximum value. It is seen then that the main portion of the secondary electromotive force will be delivered with great suddenness at the time when the exciting current passes through zero.

In dealing with 40 cycles per second this electromotive force will be delivered during 1.5 per cent. of the time of one alternation or in about one five-thousandth of a second. It is seen, also, that the residue of the secondary electromotive force constitutes an alternating pressure that is one-quarter cycle behind the primary exciting current. The cross-section of the restricted area of the magnetic circuit with reference to the amount of pressure applied in the primary circuit for excitation is proportioned so that the amount of irregularly delivered flux cannot appreciably alter the exciting current, as it would otherwise be established from instant to instant.

The secondary of the transformer (T) is connected to the pressure circuit of a dynamometer—a Weston wattmeter does very well—through the field coil of which passes the current whose form is to be determined and which is set up by the source pressure through some appliance (X). Let us call the sudden-time integral value of the secondary electromotive force e, the instantaneous value of the current c, the effective value of the residue of the secondary electromotive force E and the effective value of the current C, then the reading of the wattmeter will be:

$W = e c + E C \cos \Theta$, where Θ is the angle of phase difference between E and C, from which we may deduce the value of c. The phase of the exciting pressure delivered by M. S. may be changed by moving the motor secondary or by a proper change in the value of the combined polyphase electromotive forces applied in the phase-changing transformers, as the case may be, and a new instantaneous value of the current corresponding to the above change in phase will be obtained. In the same manner other values of the current may be obtained until the form of the current curve is sufficiently well defined. To apply the correction E C cos Θ involves so much attention and labor as to make this method valueless, if it were not for the fact that it can be quite completely compensated for in the following manner: The exciting current through the primary of the transformer (T) is passed through the primary of a suitably designed open-circuit transformer (O C T), and through the secondary of (O C T) the connection of the impulse secondary from (T) is made on its way to the wattmeter. The electromotive force developed in the secondary of (O C T) will be one-quarter cycle behind the primary exciting current of the impulse transformer (T), and therefore in unison with the residue electromotive force of the impulse secondary of (T). The secondary turns on (O C T) are adjusted in number, so that the electromotive force generated will equal the residue electromotive force of the secondary of the impulse transformer (T), so that when the connection through the secondary coil of (O C T) is reversed the residue electromotive force of the (T) secondary will have been compensated for.

The reading of the wattmeter will then become $W = c e$, and since e is constant, the values of W will be proportional to c or the instantaneous values of the current.

By using a dynamometer voltmeter, such as the Weston type, in which separate terminals for the movable-pressure coil and field circuits have been arranged, the forms of alternating pressures and of tiny alternating currents may also be determined.

Thus this method is practicable only for instances where the plus and minus alternations are alike, which is the case in much alternate-current practice. Where, however, the positive and negative forms differ, one or more aluminum cells should be placed in series with the impulse secondary. Such cells have a small internal resistance, and after having been charged with a direct current will completely cut off one side of the alternating impulse, provided the instantaneous pressure in the circuit at no time exceeds 20 volts per cell. Thus equipped the method may be used with Weston or similar make of instruments for form measurements in great variety and with ease and facility. This method is practically the same as Dr. Duncan's,[1] except for the manner in which cyclic impulses are obtained.

A Trial of the Method.

At my suggestion a trial of this method was made by Mr. Lyman H. Brown during the spring of 1898 in the laboratories at Cornell.[2]

Design and Construction of the Impulse Transformer.—Figs. 2 and 3 give a plan and elevation of the transformer as constructed and used by Mr. Brown. The following are the important dimensions and specifications: The core was built up without joints from 10 mil Apollo "electrical sheets," from which the burr due to shaping was carefully removed. The oxide on the sheets afforded the only insulation against eddies. The frame for bolting the core together was of brass; it did not extend over the restricted section of the core. The bolts were thoroughly insulated from the core and brass frame. The supports and base were made of oak.

Number of turns in primary	547
Size of primary	14 B. & S. G.
Number of secondary turns adjustable	
Number of sheets	48
Thickness of a sheet	.01 in.
Area of contracted cross-section of core	.25 sq. in.
Area of uncontracted cross-section of core	1.5 sq. in.
Length of contracted section	2.5 in.
Total length of magnetic circuit	10 in.
Normal primary exciting current	3 amperes.

On the assumption that a sufficient phase-changing pressure is applied in the circuit through the primary of this impulse tronsformer, so that the irregularities in the flux set up in the core will not appreciably alter the form of the exciting current, and with the aid of a B-H curve for the Apollo iron, I have calculated the following sequence of electromotive forces that will be set up per turn throughout one-quarter cycle in the secondary of this impulse transformer, when working at 40 cycles per second. The fractions in the time column give the portion of a quarter cycle that has lapsed since the exciting current passed through zero; the figures under B show the flux density in lines per square centimeter in the contracted section of the core, and the values under E in brackets, showing the time

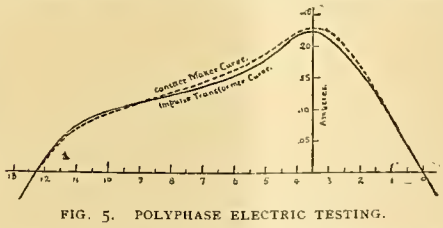


FIG. 5. POLYPHASE ELECTRIC TESTING.

interval over which they were estimated, give the average of the electromotive forces developed per volt in the impulse secondary.

Time.	B	E
0.00	0	3.24
.01	12,500	
.02	14,900	.623
.03	15,800	
.04	16,400	
.05	16,800	
.06	17,200	.1065
.07	17,400	
.08	17,700	
.09	18,000	
.10	18,200	.0644
.20	19,200	
.30	19,800	.0258
.40	20,300	
.50	20,800	
.60	21,150	
.70	21,400	
.80	21,450	.00644
.90	21,500	
1.00	21,550	

The corresponding impulse curve of electromotive force and time is given in Fig. 4 for a complete alternation. The broken curve shows the estimated compensating electromotive force that should be provided by the secondary of the transformer (O C T) in Fig. 1.

Experimental Trial made by Mr. Brown.—A compensating open-coil transformer was used that had the following dimensions:

Core of laminated iron, ring pattern	
Mean diameter of ring	8.75"
Cross-section	1¾" × 2½"
Air-gap	⅛"
No of primary turns of No. 10 B. & S. G	121
No. of secoodary turns adjustable	

A 150-watt scale Weston wattmeter, wound for 150 volts and two amperes, was used as a dynamometer; the resistance of the pressure coil was cut down to a point where the instrument operated over a desirable range. Ten secondary turns were placed

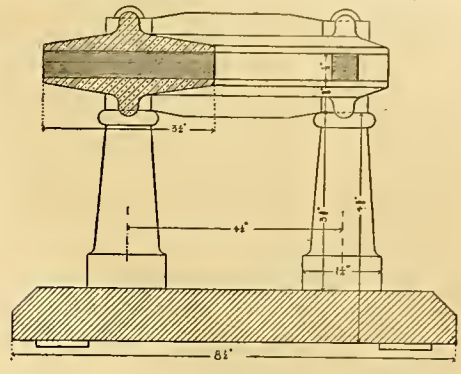


FIG. 3. POLYPHASE ELECTRIC TESTING.

on the impulse transformer (T), and the same number was found necessary for compensation on the (O C T) transformer.

At (X) in Fig. 1, the secondary of the 10-light transformer reported upon in the Transactions, vol. viii., page 1, was connected through the field coil of the wattmeter to one pressure of the triphase source. The primary was kept on open circuit. By means of an auto-converter, the source pressure was so adjusted that a normal flux was established in the core of the 10-light transformer (X). For a phase-changer a Siemens & Halske three horse power, 33-cycle, triphase, four-pole, 110-volt induction motor with a ratio of transformation of approximately one was used. By means of an index wheel and brake attached to the motor pulley the motor secondary could be set to develop any desired phase for the exciting current of the impulse transformer. The phase-changing pressure was set at 100 volts and the current controlled partly by reactance, and adjusted to the desired value of approximately three amperes by means of a non-induction resistance. A complete reactance control and a higher phase-changing source pressure would, however, have been better.

In Fig. 5 the unbroken curve is an alternation of the magnetizing current for the transformer at (X), as obtained by Mr. Brown in the employment of this method, while the curve is the mean of the two alternations for the one given in Transactions, vol. vii., page 12, as obtained by the contact-maker therein employed. The three-phase generator which supplied current for the experiments had its armature conductors distributed on a smooth core, and developed at no load a fair approximation to a sine curve of pressure. The full-load current output of this generator was 20 amperes, while the induction motor used for phase changing required 10 amperes for field excitation. The armature reaction produced by this exciting current was comparatively large, causing the generated pressure curve to differ some from the pressure curve used at the time the original contact-maker measurements were made.

There is, therefore, a fair practical agreement between the curve taken with the polyphase-impulse transformer method and the curve taken with the contact-maker. It was found by Mr. Brown that 10 impulse-residue electromotive-force compensating turns were necessary, while my estimates showed that but five should have been necessary. This difference is probably due to the fact that the sheets were not annealed after they had been tooled into shape, and that complete reactance control of the exciting current for the impulse transformer was not used.

No experiments have been made in which the aluminum cell was used to cut out either the plus or minus impulses, so that the forms of unsymmetrical curves could be determined. Experimental data have been obtained by H. J. Hotchkiss,[1] from which it is seen that the aluminum cell will be found to be reliable for this purpose.

Statistics show that in 1893 3,030 lamps met the requirements of consumers of electric light in the city of Brussels. At the present time there are 66,000 lamps. In consequence of the constantly increasing use of electricity, the city has been obliged to enlarge its works. It is now proposed to acquire five new vertical engines of 1,000 horse power each, to be placed in works already supplied with five horizontal machines of 500 horse power each.

1. Read at the general meeting of the American Institute of Electrical Engineers, Boston, June 26, 1899.

1. Transactions, vol. ix., p. 179.

2. Thesis, Lyman H. Brown, Cornell University Library, T-1898, No. 30.

1. Physical Review, March, 1899.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 17th to 21st.

Chicago Exposition of Electrical Arts, Tattersall's, September 25th to October 9th.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

Not only those using automobiles or engaged in the horseless-carriage industry that is now springing up will be grateful to Judge Gibbons for his decision setting aside the absurd rule of the Chicago South Park commissioners, prohibiting the use of moto-vehicles on the parks and boulevards of the South Side, but all friends of progress as well. Assuredly the new vehicle has come to stay, and the pronunciamento of the South Park Board had a trace of the cheerful complacency of the worthy Mrs. Partington of Sidmouth, who deemed her trusty mop a fitting implement of warfare against the Atlantic Ocean. Judge Gibbons not only declares the rule discriminating against the automobile to be illegal, but he takes occasion to say a good word for the self-propelled vehicle and its intelligent use.

It is but natural that the stockholders of the Eastern Telegraph company and the Eastern Extension, Australasia and China Telegraph company, who have been receiving regular dividends of six and seven per cent. for the last 25 years, should view with some alarm the prospective construction of one or more telegraph-cable lines across the Pacific. A deputation of them waited on the British secretary of state for the colonies, Mr. Chamberlain, and the chancellor of the exchequer, Sir Michael Hicks-Beach, last week, and gave voice to their fears, but they received but cold comfort. The Marquis of Tweeddale, who is chairman of both companies, and others expressed objection to state competition with private enterprise, referring to the proposed Pacific cable, and Sir Michael Hicks-Beach promised to furnish a written answer. In the meantime, he reminded the deputation, the Pacific cable project was not new and was one the government had a perfect right to undertake. Mr. Chamberlain said, too, that while customers justly complained of the existing high rates, it was mainly for the sake of an all-British cable connecting all portions of the empire that the government entertained the present project.

Then the noble marquis proceeded to unfold a little scheme. He declared that the proposed cable would speedily lead to the ruin of the cable companies the delegation represented, and advanced the alternative plan of providing for the formation of a British imperial telegraph company to take over the securities of the present companies, the stock of the new company being guaranteed by the government at 2½ per cent. interest, the present large reserve fund of the companies being used to lay the Pacific and other cables, and the surplus revenue from the reduction of interest to be devoted to reducing rates and relieving the capital. Sir Michael Hicks-Beach said that the best answer to the Marquis of Tweeddale's ambitious proposal was that neither India nor Australia was prepared to support it. He also made bold to demur entirely to the objections raised and strongly intimated that they were untenable.

But, British cable or no British cable, American interests on the Pacific demand, in any event, a telegraphic line connecting the United States, Hawaii and the Philippines, and controlled by this government.

The important report of the committee on standardization of the American Institute of Electrical Engineers is given in full in this issue. It was presented at the general meeting of the Institute in Boston, a preliminary report having been submitted a year ago at Omaha. The report is of considerable length, yet it is difficult to see how it could have been abridged and cover the wide range of subjects that necessarily had to be considered. It is pressed down and running over with conclusions of fact. In sections numbered from one to 82 it states the decisions of the committee on the proper standards of efficiency, rise of temperature in electrical machinery, insulation, regulation, variation and pulsation, rating, classification of voltages and frequencies, and overload capacities. In a brief prefatory note the committee says that many other matters—testing, for example—might have been considered with advantage, but that it was deemed inexpedient to attempt to expand the present report to greater size.

For several reasons this report should have the careful attention of the electrical fraternity. One is the importance of the subject. Ever since the electrical industry began to approximate its present extent, thoughtful men engaged in it have perceived the great advantage of standards of work and standards of manufacture, if they could be arrived at. This need has been the theme of papers and discussions, and on March 23, 1898, Messrs. Crocker, Hutchinson, Kennelly, Lieb, Steinmetz, Stillwell and Thomson were appointed by the Council of the Institute to consider the queston. It is a report from this committee that is now made public. The standing of the gentlemen named, as engineers, is of itself an excellent reason why the definitions and statements they have made should be respectfully considered. Other reasons are the facts that the report was made under the auspices of the Institute, which seems to be the proper body to attempt the desired improvement, and the excellent character of the report itself. The work seems to have been carefully and thoroughly done, and although it is of such a character that its ultimate usefulness cannot now be foreseen, there can be no doubt whatever that the committee has made a most valuable contribution to the literature of the profession which its members adorn.

That electrically transmitted power is supplanting steam-railway locomotives, to some extent, cannot be denied. The elevated railways of Chicago, Brooklyn and New York could be cited, off-hand, as examples of the change, if the statement were questioned, and other instances will occur to persons familiar with the subject. But what is the limit of electrical application to railways now dependent on steam locomotives? Has it been reached, or nearly reached, already, or will the time come when the great trunk lines will be equipped for the electrical operation of some or all of their trains? This is a question which many railroad men are studying carefully, and usually without prejudice. These gentlemen have confidence in the locomotive as an old and tried friend; but they still continue their search for the best economy in transportation. But some of them do look askance at the simple electric motor and shake their heads doubtfully. Here is Col. William H. Stevenson of Bridgeport, Conn., for instance, said to be a railroad man of prominence, who thinks that the electric trains now being run on the New Canaan branch of the New York, New Haven and Hartford railroad, and also from Berlin to New Britain, have not proved that electricity is capable of doing the work of steam. "Those electric engines would be a fine thing to use through the tunnel from the Grand Central Station to Harlem," the colonel is reported as saying. "They would do away with the smoke problem, but I am convinced that for general railroad work they will never amount to a row of pins. Electricity will never pull a train of ten cars over the mountains of Pennsylvania. Compressed air won't do it. It takes a steam engine, with a man to feed it on coal and water. Steam will never be supplanted by electricity as a motive power."

This doesn't seem to be much of an argument, for surely any practicable amount of power can be electrically transmitted to the mountains of Pennsylvania or to any other point where railroads run. It is a question of expense. This seems to be the opinion, also, of the American Society of Civil Engineers, which, at its recent convention, discussed the question, "What are the economic conditions under which electricity may be profitably substituted for steam in the operation of branch railroad lines, and what are the engineering requirements to be considered on such substitution?" Henry S. Prout of New York, R. E. Moore of St. Louis, Oberlin Smith of Bridgeton, N. J., W. L. Webb of Philadelphia, J. J. R. Cross of New York and others took part. The conclusion was that in the opinion of the members electricity is far more expensive than steam where traffic is spasmodic, but where it is fairly continuous electricity may be used more cheaply. This is practically the opinion of Dr. Louis Duncan, who made an exhaustive study of the subject a few years ago. If this view is correct, it may be that the railroad of the future will be fitted for both steam and electrical train operation. However, the revolution, if it is to be effected, will be a very gradual one—step-by-step development, like the improvement of the steam locomotive itself. It is best not to dogmatize on either side.

Canadian Electrical Association.

[Special correspoodence of the Western Electrician.]

Hamilton, Ont., July 1.—The city of Hamilton, pleasantly situated on the western extremity of Lake Ontario, was the place chosen for the holding of the ninth annual convention of the Canadian Electrical association, which opened in the convention hall of the New Royal Hotel on Wednesday, June 28th, at 2 p. m., and continued in session that afternoon, Thursday morning and afternoon, June 29th, and Friday morning, June 30th, when the proceedings were brought to a close.

There was a very large attendance of central-station, telephone, telegraph, electric-railway, light, power and supply men. The register of the association contained the following names: Messrs. J. A. Kammerer, Toronto; J. J. Wright, Toronto; A. E. Payne, Toronto; J. W. Campbell, Toronto; E. B. Biggar, Toronto; A. B. Smith, Toronto; C. H. Mortimer, Toronto; P. G. Gossler, Montreal; John Carroll, Montreal; John Yule, Guelph; George Black, Hamilton; E. E. Cary, St. Catherines; G. A. Powell, St. Catherines; A. A. Dion, Ottawa; O. Higman, Ottawa; C. Thomson, Ottawa; W. H. Browne, Montreal; George C. Hinton, Vancouver, B. C.; Alexander Barrie, Montreal; W. J. Plews, Montreal; H. O. Fisk, Peterboro; W. Ahearn, Jr., Ottawa; John Murphy, Ottawa; F. H. Leonard, Jr., Montreal; D. H. Henderson, St. Catherines; William A. Turbayne, Hamilton; J. F. H. Wyse, Brantford; P. H. Hover, New York; S. E. Fletcher, St. Johns, P. Q.; C. H. Wright, Montreal; J. E. Bilger, Berlin; D. R. Street, Ottawa; W. Williams, Sarnia; A. P. Horner, Toronto; J. J. Ashworth, Toronto; George H. Olney, Montreal; John C. Guyfer, Ingersoll; E. Irving, Hamilton; J. W. Purcell, Walkerville; W. G. Angus, Hamilton; F. W. Martin, Hamilton; George W. Shand, Sarnia; A. A. Wright, Renfrew; W. W. Maclaren, Montreal; H. C. Ross, Montreal; W. F. Green, Berlin; A. Sangster, Sherbrooke; R. E. Pringle, Montreal; J. B. Griffith, Hamilton; L. A. Somers, Halifax; T. R. Rosebrugh, Toronto; Gordon J. Henderson, Hamilton; Fred Thomson, Montreal; James Waddell, Charlottetown, P. E. I.; P. H. Hart, Montreal; A. Esling, Toronto; W. W. Grant, Ottawa; John Philip, Grand Valley; H. S. McLaren, Montreal; A. C. McDonald, Toronto; W. A. Mackay, Renfrew; H. R. Leyden, Hamilton; J. Sangster, St. Catherines; George F. Haworth, Toronto; C. A. Woolsey, Montreal; W. M. Warrington, Toronto; E. D. McCormack, Toronto; John Anderson, Windsor; A. D. MacArthur, Toronto; E. A. Wallberg, Montreal; C. H. Waterous, Brantford; B. F. Ressor, Lindsay; Stephen Noxon, Ingersoll; Joseph Rogers, Toronto; William McCaffrey, Toronto: Mark B. Thomas, Dundas; William T. Bonner, Montreal; John Milne, Toronto; H. W. Woodman, Hamilton; A M. Wickens, Toronto.

The committee which did much to make the convention a success included E. E. Cary, manager Packard Electric company, St. Catherines; A. B. Smith, superintendent Great Northwestern Telegraph company, Toronto; H. R. Leyden, manager Cataract Power company, Hamilton; A. J. Nelles, manager Hamilton, Grimsby and Beamsville Electric Railway company; Mark B. Thomas, manager Hamilton and Dundas Electric Railway company and of the Dundas Gas company; George Black, manager Great Northwestern Telegraph company, Hamilton; C. K. Green, manager and electrician Hamilton Radial Railway company, and Gordon J. Henderson, manager Hamilton Electric Light and Power company.

An address of welcome was made by Mayor Teetzel, one of the learned queen's counsel, and the leading member of the Hamilton bar.

The chair was occupied by W. H. Browne, manager of the Royal Electric company of Montreal, who delivered a most interesting address, after which the secretary-treasurer, C. H. Mortimer, read the minutes of the last convention, together with his report, which showed the association to be in a flourishing condition.

The chairmen read reports of the standing committees on legislation, statistics, meters and meter inspection and the special committee to confer with the Quebec Board of Fire Underwriters.

Mr. A. A. Dion's paper on "Meters and Meter Rates" was one which elicited a great deal of discussion on meter testing and meter rates.

"Central-station Accounting from a Business Standpoint" was the title of a paper read by Mr. P. H. Hart of Montreal, and resulted in the appointment of a committee to report at the next convention as to the best method to be adopted in this regard.

Mr. W. J. Plews, Montreal, read a very interesting paper on "The Protection of Low-tension Wiring against Dangerous High-potential Currents," and by the aid of a blackboard upon which he had drawn a diagram answered many questions and explained to the members the working of an apparatus recently invented to overcome the difficulties set forth in his paper.

Messrs. F. H. Leonard, Jr., Montreal, W. A. Turbayne, Hamilton, and E. E. Cary, St. Catherines, contributed papers on the following subjects, respectively: "Transformer Economy," "Long-burning Enclosed Arc Lamps" and "The Incandescent Lamp for Central Stations," considering efficiency, candle power, distribution of light, regulation, and whether 220 to 240-volt lamps are likely to come into general use, also a reference to the Nernst lamp, which, on account of insufficiency of time, were not discussed.

On Wednesday evening, at five o'clock, a trip was taken by the members over the Hamilton and Dundas electric railway, and at 7:30 o'clock to Burlington Beach, returning by the Hamilton radial railway, visiting en route the power stations of the Hamilton Street Railway company and the Hamilton Radial Railway company.

At 5 p. m. on Thursday a trip to Grimsby was taken over the Hamilton, Grimsby and Beamsville electric railway, and on the return trip a visit was paid to the Hamilton Electric Light and Power company. Following this in the evening the annual banquet was held, and over 100 members and guests sat down. This pleasant feature of the convention was indulged in until the president, in the words from "Othello," said:

> In truth 'tis morning;
> Pleasure and action make the hours seem short.
> Retire thee; go where thou art billeted.

On Friday morning the closing session was held and the election of officers took place, which resulted as follows:

President—A. A. Dion, Ottawa.

First vice-president—E. E. Cary, St. Catherines.

Second vice-president—P. G. Gossler, Montreal, Que.

Executive committee (five members re-elected)—J. J. Wright, Toronto; A. B. Smith, Toronto; O. Higman, Ottawa; George Black, Hamilton, and John Carroll, Montreal, Que.; (five new members elected) D. R. Street, Ottawa; A. Sangster, Sherbrooke; J. F. H. Wyse, Brantford; B. F. Reesor, Lindsay, and W. H. Browne, Montreal, Que.

Secretary-treasurer—C. H. Mortimer, Toronto.

A vote of thanks was tendered to the retiring officers, the city of Hamilton, the local committee, the press and to all those who had contributed to the success of the convention.

At the close of the convention the members took the Grand Trunk railway for the purpose of paying a visit of inspection to the Cataract Power company's works at De Cew Falls.

The place fixed for the holding of the next convention was the city of Ottawa. G. A.

Park Commissioners' Rule Against Automobiles Held to be Void.

Judge Gibbons of the Circuit Court of Cook County has decided that the extraordinary rule of the South Park commissioners of Chicago in barring automobiles from the South Side parks and boulevards of the city is void. This decision is undoubtedly good law and certainly sound sense. It will meet with general approval.

The decision was rendered in the case of Harry G. Osburn, electrical engineer of the American Electric Vehicle company of Chicago, who was arrested for running an automobile on Jackson boulevard in violation of the rule mentioned. A writ of habeas corpus was sued out before the Hon. John Gibbons, judge of the Circuit Court of Cook County, Joseph Kipley, chief of police, Daniel O'Neil and J. Frank Foster, superintendent for the South Park commissioners, being named as defendants. W. Clyde Jones of Ludington & Jones appeared for the relator, Mr. Osburn, and R. P. Hollett for the respondents.

The text of the opinion is as follows:

"The Board of South Park commissioners a few days ago passed an order directing their superintendent to exclude automobiles from the parks and boulevards under their control, and, in obedience to such order, the relator, who was operating an automobile on Jackson boulevard in defiance thereof, was arrested. He immediately sued out of this court a writ of habeas corpus demanding his release from arrest, on the ground that the said order is unreasonable, unconstitutional, and therefore void.

"As it is assumed for the purpose of this case that the South Park commissioners complied with all the usual formalities in respect to the passage of by-laws or ordinances, the question arises whether, under any form of law, it has power to exclude automobiles from the boulevards within its jurisdiction.

"The South Park board was created by special charter passed by the Legislature of this state in 1869. And the commissioners are, by said act, empowered to acquire land, which shall be 'held, managed and controlled by them and their successors as a public park, for the recreation, health and benefit of the public, and free to all persons forever, subject to such necessary rules and regulations as shall, from time to time, be adopted by said commissioners and their successors, for the well ordering and government of the same.' By subsequent legislation the board has been empowered to acquire, public streets leading to parks under its control, and the board has all the power, authority and jurisdiction over park property and boulevards which is exercised by the Common Council of a municipality over the public squares and places under its jurisdiction. (McCormick vs. South Park Commissioners, 150 Ill., 516.)

"The Legislature leaves no room to question the object which it had in view in creating the board and enabling it to acquire, purchase and condemn property for park purposes, for it declares that the land so acquired shall be held, managed and controlled by them and their successors as a public park for recreation, health and benefit of the public, and free to all persons forever.

"There are few things in life which afford me greater pleasure than to visit one of the parks on a Sunday afternoon, during the summer season. I behold there a picture which, to me, is not only grand, but inspiring. Men, women and children, from every walk of life, meet there on a common level, and all seem so happy, and the little ones are so mirthful, and the band discourses such enchanting strains of sacred music that one is forced to exclaim, 'This is, indeed, the paradise of the poor.'

"Monopoly seems to be the inspiration and realization of the times—monopoly of capital, monopoly of labor, monopoly of trades, monopoly of professions. Can we not afford to permit the poor to enjoy a monopoly also? A monopoly of the parks which were purchased and beautified for the recreation, health and benefit of the public? Yes, the parks are theirs; they have become the birthright of the poor, and the man who would destroy their usefulness as the pleasure places of the poor should receive summary and condign punishment.

"The parks and boulevards are the sacred places of the common people, and they must not be desecrated by the mammon of iniquity.

"This case is important, not only as to the power of the board to pass the order in question, but how far it may go in permitting the parks and boulevards to be used by automobile companies for gain or profit. Our boulevards in and between our park systems have cost us millions of dollars, and it would be a very convenient thing for an individual or corporation to take possession of them, with or without the license of the park board, and to use them for carrying passengers for hire.

"The time may come when the commissioners will grant licenses for the use of those boulevards, but there is so much territory all around us, there are so many streets, why should not the parks and boulevards be held sacred for the objects for which they were acquired?

"The automobile has come to remain with us, and we welcome it as a great improvement over horse cars and the ordinary street car. The time is not far distant when no horse car, trolley car or cable car will be permitted to occupy any of our business streets. They have served their purpose. They should be either above or below the surface of our streets.

"The Board of Park Commissioners have no right to prohibit any vehicle, used for recreation or pleasure, from using the boulevards, so long as it does not endanger the safety of others. It has no right to prohibit the automobile by name any more than the bicycle or tricycle or dogcart, but it has the right and it is its imperative duty to prohibit any vehicle, whether bicycle, horse carriage or automobile, within the parks to run at a higher rate of speed than four or five miles an hour. Any higher rate of speed endangers the safety of the women and children who resort there for recreation and pleasure. The board has the power to set apart certain drives or places where they may prohibit vehicles from going, or, where they have the facility, they may designate what part of a boulevard should be used by bicycles, for example, and may prohibit any other kind of vehicle from encroaching upon that territory. But where there is but one north and south boulevard, the board has not the power to prevent the fortunate owner of an automobile to use that boulevard for pleasure.

"Aside from the question of passing an ordinance which is on the face of it unreasonable, the board has almost plenary power over the parks, and it is well that it should, because, as already stated, the parks are a great and growing blessing to the people.

"The order in question is void in singling out automobiles by name and placing them under the ban of outlawry, when, as a matter of common observation and scientific knowledge, there is less danger in propelling an automobile than there is in driving a horse and buggy. The relator is discharged."

C. E. Corrigan, general manager of the American Electric Vehicle company, is very much pleased with the result.

Exports of Electrical Machinery.

[From the Washington corresoondent of the Western Electrician.]

The steady progress of the expansion of our export trade in electrical machinery is attested by figures recently compiled by the Treasury Department, from which it is learned that the exports in this line during the month of May were valued at $241,103, as compared with a value of $180,494 for the corresponding month of last year. For the eleven months ended May 31st a total valuation of $2,517,797 is recorded, as against $1,883,306 for the eleven months ended May 31, 1898. The exports of instruments and apparatus for scientific purposes, under which classification are included telegraph, telephone and other electric apparatus, also show large gains, the value for the eleven months of the current year being $3,929,073, as against $2,521,280 for the preceding eleven months.

TRIFLING TECHNICALITIES.

We are a witless world, I wot,
To work all day when it's so hot.
Now that we have electric light,
Let's sleep all day and work all night!—Chicago Record.

Electric vehicles are barred from some of the parks of Chicago. We suppose it is because they are so ugly in appearance that they shock the æsthetic taste and interfere with the recreation and respite of those who flee to the parks for relief from the rest of the city.—New York Tribune.

DEVELOPMENT OF THE TELEPHONE FIELD.

Value of Long-distance Toll Lines.[1]

By S. P. Sheerin.

The toll line is the youngest child of the telephone family; the latest comer, but the strongest and most robust of them all. Without in the least disparaging any of the branches of the great telephone industry, it must now be conceded that the toll line takes precedence of all others in importance and general usefulness to mankind.

The exchange in its inception was thought to be a convenience by most business men, while a large number regarded it merely as a toy. Little by little, it grew in favor in spite of the restrictive management which confined it to a comparatively small area, in towns and cities, and limited its use to the members of each community who could afford to pay a high price for it. But the telephone exchange, while a great aid to business, and a great convenience, could not be called an indispensable thing. It made work lighter and saved time, but it did nothing which could not have been done in some way without it. Distances in towns and cities are comparatively short, and business could be fairly well done without it. One of the great needs of man is that of communication with his fellows. Civilized man must have someone to talk to. The early highways of the world were planned and carried forward, not so much by men who had commodities to exchange, as by men who had ideas to communicate to other men along the road.

Interchange of thought is the upbuilding influence in the development of a country. A man's pleasure in the interchange of commodities depends entirely upon the profit he has in it. In the interchange of thought, every good man believes that the other fellow has all the profit, and is delighted that it is so.

The telephone toll line has brought the sons of men closer together than they have ever been since that bright morning long ago when Noah left the Ark.

One cannot get much closer to another than to be given an opportunity to whisper in his ear. The man who had the ear of the king was often a much more important individual than the king himself. The telephone toll line has the ear of the world, and, unlike the man who had the ear of the king, it uses its position for the benefit of the world. It has annihilated space and puts the lips of the New York man to the ear of the St. Louis man with perfect ease. In shorter distances its work is equally effective. The ear of the doctor in the country town is brought to the lips of the father twelve miles away, whose daughter has become suddenly and dangerously sick, and the doctor is at the bedside of his patient two hours sooner than he otherwise could have been.

It would be useless for me to attempt to recount in detail the many advantages of the toll line. The people are testifying to its worth as an increaser of the sum of human happiness by the thousands of miles of line they are putting in every year.

We must bear in mind that the real development of the toll line dates from the inauguration of this independent movement. The farmer and the resident of the small town never had any place in the consideration of the men who owned the telephone patents, so long as they were in force. As a monopoly the telephone was a selfish and snobbish aristocrat, who despised the simple ways and slender purses of plain people, and demanded high tribute from those who could afford to pay. His motto was, "the largest possible revenue from the smallest possible number of telephones." The toll lines were run upon the same narrow plan, and the farmer had about as much chance of getting a telephone, even when he was willing to pay a fair price for it, as he had of getting a string from the golden harp of the prophet. But the people of this country, when they want a thing, always find a way to get it. The fellow who does not serve the people when he can is not always given a second chance. The telephone monopoly utterly failed to cover the field. They purposely and insolently refused to cover it, and refused to allow anyone to do so.

Parenthetically, I would like to make a bit of prophecy right here; that is, a thing that will not be possible twenty years hence. The lawmakers and courts of this country will not continue to allow a patentee to deny the benefits of his invention to people who are willing to pay for it. It is all right for the patentee and his assigns to have the right to enforce ample compensation, but this country will not continue to permit oppressive denial of benefits to men who are willing to pay for them.

The independent toll lines of the United States are not more than four years old, and there are over 45,000 miles of them. No other one interest in the world has ever shown a development equal to this in the time. They are not all good lines. They could not have been owing to the conditions under which they were brought forth. All the early ones were built with the noisy threats of patent litigation, damage suits, etc., ringing in the ears of the builders. Still, there is not a foot of independent toll line, no matter how bad, that hasn't served a good purpose. They have all been educators.

The toll line in the farming district is a veritable Godsend. The telephone means more to the farmer than to the man in town. Distances with him are greater and social intercourse more difficult. His protection, too, is very much less than that of his brother of the town. All these things the telephone gives him. It gives his ear to his neighbor and his neighbor's ear to him. The farmer's toll line is already as much of an institution as the farmer's barn. The more farmers there are who have telephones, the more townspeople there are who will have to have them.

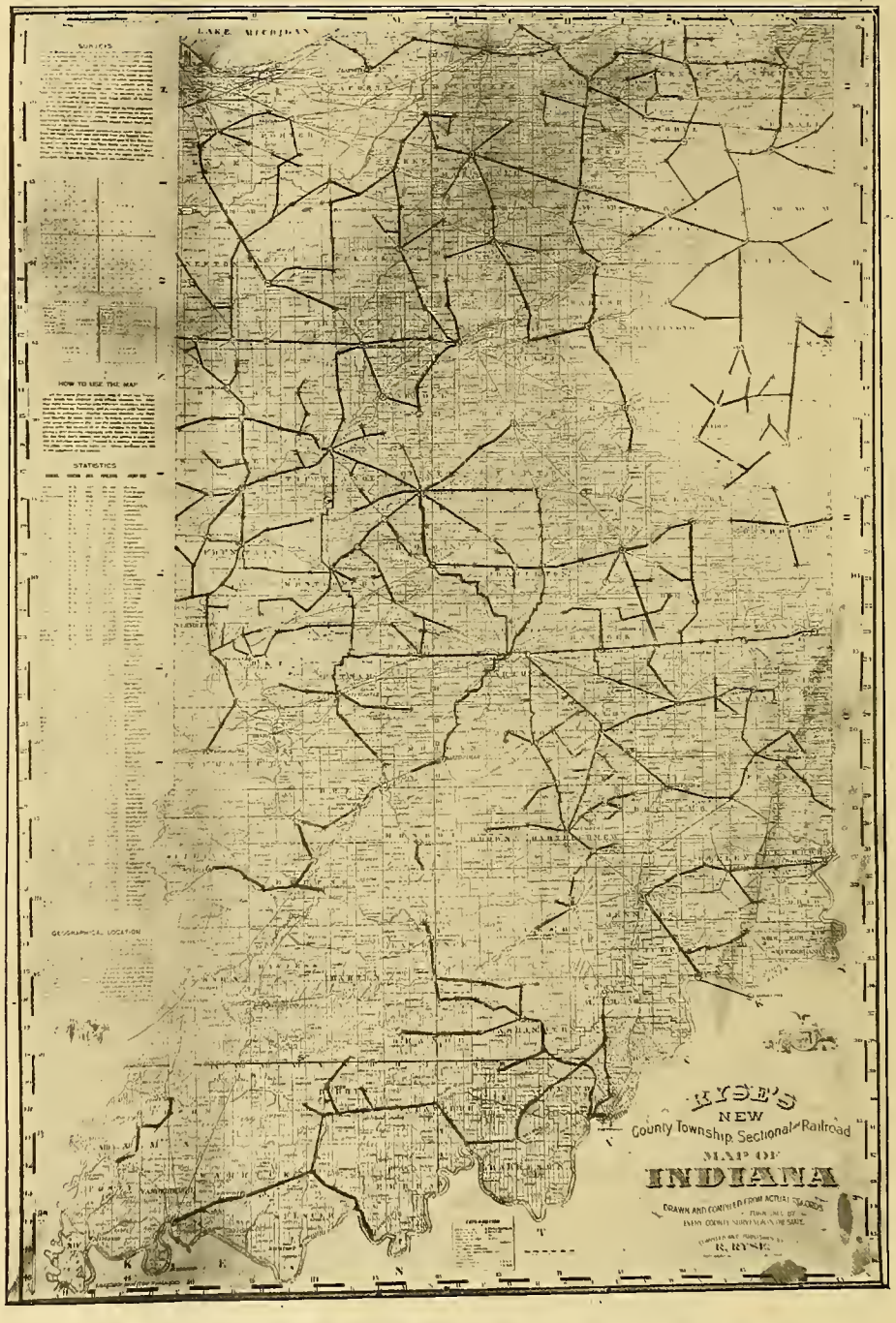
The question now is how to make these toll lines most serviceable and most profitable to their builders and operators? My answer to this is in three words, "Build good lines."

Notwithstanding the shortness of the time since the beginning of this independent toll-line movement, it is already far beyond the experimental stage. There is now no earthly excuse for putting up poor toll lines. The toll-line business to hold its own must line up with the other construction of the country. We have left the log house and the rail fence a good ways behind. The corduroy road is a thing of the past and wheat is no longer threshed with flails. Discourage the putting up of anything but metallic lines, on good cross-armed poles, close enough together. For the farmer to have the best results from his 'phone he should be able to talk with ease from his house to all the towns in which he is likely to have business.

Fair arrangements, based upon absolute equity, should be entered into by all companies for an interchange of toll business. Public toll stations should be as close together as possible, and these should always be in the hands of obliging and capable people. Rates should be such as will give fair remuneration, and as nearly uniform as possible. Between the larger lines interstate arrangements should be made for through business with the smallest possible amount of red tape. The whole independent movement has a field and a mission peculiarly its own. It is bone of the people's bone and flesh of the people's flesh. It was born of the spirit that made a teapot of Boston harbor. It has been from the start a vitalized declaration of the right of every man to enjoy every public utility that is enjoyed by every other man. The justice of the contention is now fully admitted by the organization which until a few years ago was the great telephone monopoly of the United States. There is no longer such a thing in this country, as a telephone monopoly. There are now two large telephone interests. One, a mere bantling scarcely more than four years old, which has not yet fully come to a realization of its own strength and importance. The other an elderly, sedate and somewhat reflective sort of monopoly, making what may or may not be an honest effort to atone for the numerous indiscretions of its past. The bantling now sets the pace and leads the way in every telephone contention on this continent, and the other follows with a more or less vigorous "me too."

The small towns and country districts of this country would have been without telephone service forever but for this independent movement. The other people, now that the independents have blazed the way, meekly fall in line with smiling face and arms filled with telephones, and softly chant "me too." I am not at all anxious about the result; the people of this country know a good thing when they have it.

This independent movement needs but one thing,



MAP SHOWING EXTENSION OF INDEPENDENT TELEPHONE LINES THROUGHOUT INDIANA.

1. Read before the Independent telephone association, Chicago, June 27, 1899.

and that is close and intelligent organization. Its interests and dangers are identical in every town, county and state of this Union. It is a giant in strength and a Dewey squadron in possibilities, if it but act unitedly. The toll lines should be the band and bond of union in this independent movement. They are the spinal column, the nervous system and the circulating blood of the whole thing. No exchange can live without good toll-line connections no more than toll lines can live without exchanges. Their fortunes are inseparably linked.

All possible encouragement should be given to the putting up of good toll lines. Toll-line rates should be as nearly equitable as they can be made, and toll-line companies should treat all exchanges absolutely alike in the division of tolls. There should be no paralleling of each other's lines when it is at all possible to avoid it, and the exact relations of companies to each other should be set out in long-time written contracts. In short, everything should be done that can be done to put the whole movement on a strictly business basis. The world will never be without telephones nor without toll lines. Within five years every fourth house in the United States will have a telephone. Let us see to it that they have ours and are pleased with them.

Discussion.

Mr. De Land: It seems to me that the independent people could make a good point by taking up the question of toll lines on the Sabin system. Mr. Sabin has made a signal success by cutting up the minute into halves and three-quarters. Very few people understand that they can talk 70 words in 30 seconds. Take out your watch some time and see how many words you can utter, speaking slowly, in 30 seconds; then 45 seconds, and then 60 seconds. Mr. Sabin gives a rate of 10 cents where the three-minute rate would be 30 or 35 cents. Very often men will come into your exchange who do not care to pay 35 cents to talk to a neighboring town, because they have very few words to say. A man can possibly close a deal in 20 or 30 words. If he can get a 10-cent rate and occupies the line less than a minute, including connection, your line is then ready for the next customer. If you have two or three lines, you can make them quite profitable in that way.

Mr. Baird: I would like to hear from some gentlemen who have had experience with toll lines as to how they overcome the conflicting interests of the different companies. For instance, take a company whose line would cover a whole county, perhaps run into two counties; on account of the Bell people giving free service over the same district, the independent would have to give free service also.

Now, how do they connect up these toll lines so as to overcome these conflicting interests?

Mr. Fisher: There is one point, particularly, that I want to make a suggestion about; that because the Bell people give free service we have to do the same thing. I don't think there is any "because" in that. Our experience in Michigan, where the independent company charges a fair price for good service, is that if the Bell company gives absolutely free service in that community, the Bell company is not in it. We have had numerous instances in our state, and I know there are plenty of such instances in Ohio, where the people of the entire community substantially have refused free service. The people of Michigan and the people of Ohio and the people of Indiana are like the people in the rest of the United States. You make them understand what is at issue and what they ought to do, and they will do it every time. That "because" I want left out, if you please.

Mr. Harvey: I agree with the gentleman from Michigan. We got our lines together, where the Bell people charge 15 cents for 10, 15 or 20 miles, and we charge a quarter, and the people always come to us.

Mr. Ottenstatt: I would like to ask the gentleman who just had the floor what arrangement he makes with his neighbors about charges?

Mr. Harvey: When a company comes to us, we agree that "You use our line, and we will use your line, and you take the money that you get and we will take the money that we get."

Mr. Reutinger: I would like to ask the gentleman a question as to what he does in case he sends a message over the lines of another company, an intermediate company.

Mr. Harvey: Well, Mr. President, three companies have united under that plan, and there are several more who want to unite under the same plan. In the case of the three companies that have united if the message goes clear over one man's line it is all right; they only use the line for a few minutes, and he uses ours, and it all comes out right in the end. It is the same as if it was all under one company's control.

Mr. Hill: We are operating on the same plan in four counties, centering in Clinton, Ia., with 1,300 telephones on the reciprocal plan. They carry our business and we carry theirs—Mr. Potter of Lee County and the Clinton company, the Carroll County company and ours, and the Whiteside and Harrison County, and there is about between $80,000 and $100,000 invested in the business, and we work entirely upon that plan, except in the case of non-subscribers, and we are succeeding admirably.

Mr. Fair: We work on that plan, the mutual plan, with other companies with one exception, and that company we charge 60 per cent. on outgoing business, and they get 40 per cent., and of the business that comes in they take 60 per cent. and we get 40 per cent. With the exception of that one company we take all we get. We take all the outgoing business, and they take the business the other way, and we find that it works very satisfactorily. We have kept track of it, and there isn't enough difference to pay for keeping the books. We have kept careful account of that, and we have been running over four years. But where we worked through three companies, we work on a percentage—50, 25 and 25.

Mr. Reutinger: We have a different plan altogether of adjusting the business. It is an easy matter to figure out and make a card rate from one point to another, and from that point to another, and divide the rate on a certain percentage as to the mileage, and we know just exactly where we stand. On the other plan, where you take what you get and let the other company take what it gets, I do not think it is so fair. Supposing you have a large exchange, you give the small exchange the benefit of the money you have invested.

Now, for instance, if you have a line from Chillicothe to Greenfield or Washington—we will say Washington—and one company has built eight miles of toll lines, and we have built 28 miles, is it fair that we should give them all they get if we have expended $145 or $155 a mile on that line? The same way to Greenfield. If your message is 25 cents, Greenfield gets eight twenty-fifths and we get 17 twenty-fifths. That is easily figured. Another case; they have four miles, and we have something like 22 miles. If we let him have his quarter for the four miles that he has built, he would make money, and we would be out that much.

Mr. Critchfield: I know a number of exchanges in which the plan suggested by the gentleman from Illinois has been adopted, each company keeping all it gets. Now, under that arrangement, the bigger company will get more money than the small one. If one company has 10 toll stations on its lines, and another one has a hundred, the one with a hundred stations, in the natural course of events, would get 10 times as much business starting on its lines as the connecting company with 10 stations. Now, I know that there have been many companies which have kept tab on the business carried on in that way; I know of three companies adjoining that carried on business that way, starting as an experiment, and they kept books for two years, and one company was $2.82 behind what it would have been by dividing the business, and another company was less than that behind what it would have been.

The gentleman from Ohio has spoken about a mileage basis. That is not an accurate plan, and it is expensive to keep track of it. I have in mind a system that is operated by five companies, covering 11 adjacent counties. They make a certain rate from any point in one of the counties to any point in the next adjacent county. Ordinarily, the rate to the first station is 10 cents, but that is not material for the purposes of this statement. It may be 15, 20, 25 cents. For instance, a message from five miles inside of A county goes entirely across B county next adjacent; A and B divide that message equally, except 25 per cent. of it goes to the originating company in all cases, as an inducement for all companies to strive to create business on their lines. The originating company gets 25 per cent. of the toll charged, and the remaining 75 per cent. is divided between the companies operating in the two counties. One company may carry that message 25 miles and the other only carry it five. But the next time a message starts in B county and comes back to the same point in A county, A gets the benefit of its half of the 75 per cent. for carrying the message five miles, while the other company carries it 25 miles, and that equalizes the two messages.

If it is carried through three counties, for instance, starting from the line in A county over to C, across B, that message is divided in the same way, 25 per cent. to the originating company, and the remaining 75 per cent. is divided equally between the three companies over whose lines the message passes. In that way you only have to keep track of the counties. The next day a message comes back over the same line, and it is equalized again.

Now, that is the condition that prevails at this time, and it seems to be the fairest and best method that can be adopted. But that condition will soon pass away. We have all experienced the necessity of having some one trunk system to do our business to distant points, even in our own state. We cannot divide a message passing from the Ohio River to the lakes, for instance, satisfactorily. We become too much involved and tangled. The proper system is to build toll lines to connect all the independent exchanges at the different points, leaving to the local companies the business in their own county, letting them carry the business in their own county over their own lines; and if they receive a message and want it transmitted a hundred miles, it goes to the exchange point in the county seat, and there it is transferred to the long-distance line, which is built as well as any line can be built, and taken to its destination on the percentage basis. In other words, we realized long ago that we could afford to give up the business to the adjacent county seat if we could get the business of the balance of the county on a percentage basis from connecting lines. In other words, we realize that if the local lines take only such business as they can manage, and the trunk line can get the business from the eight or 10 counties over its own and other similar connecting lines, it would be money in our pockets, not only on a commission basis, but materially strengthen our exchange, if we could say to our patrons and to the public, "We will transact your business over as good lines as can be built for about 60 per cent. of what you are now paying."

Mr. Cockerell: We have toll lines connecting with lines from the south part of the state down near Missouri to the north part. We have never divided up our tolls. We have dealt upon the same plan as stated by our friend from Illinois; each man keeps what he gets, and so far, although we have kept a check on the business and might settle some time, we have never done it so far. We have found it very satisfactory.

It seems to me that the building of trunk lines or long-distance lines is the only practical method for that class of business, so that we can turn over that business to the long-distance companies. (Applause.)

Mr. Fricker: We are connected with a company that is laboring under conditions unlike anything else in the state of Ohio—our company and a neighboring company. The Jefferson and Warren companies when they asked for a franchise in Jefferson County were informed by the Ashville Council: "We will grant you a franchise on the condition that every subscriber shall have free toll service throughout the county." We were obliged to accept it. We are in Ashtabula, 10 miles from Jefferson. They wanted to get to Ashtabula. But how could they do it? They certainly could not afford to give free service to Ashtabula, connected with 500 telephones, and we would not receive them. We said to them, "We will build a line to the corporate limits of Jefferson, and you take our lines from there in, and when anyone wants to talk with Ashtabula, you charge toll, and only let them talk as far as the corporate limits." They got in in that way, and we have this arrangement with them. That also extends to Warren, 38 miles south of Jefferson. They have a rate of 15 cents, and they take 25 per cent. and we 75 per cent. of the toll.

Conneaut is 14 miles east, and they have seven miles of line, and we have seven. They charge 15 cents for a message from Ashtabula to Conneaut, and we divide that toll rate equally. Between Conneaut and Jefferson the toll is 20 cents. Conneaut receives five cents, Jefferson five cents and Ashtabula 10 cents. We have no trouble whatever in keeping those accounts and having a monthly settlement. We have contracts with them running for a long term; in fact, through the life of their franchises, as well as being a mutual contract.

Litigation over Telephone Franchise.

[Special correspondence of the Western Electrician.]

Rochester, N. Y., July 1.—In Special Term of court, before Justice Dunwell, the argument on the demurrer to the complaint in the action brought by John A. Barhite, as a taxpayer, to restrain the Home Telephone company from establishing and operating a telephone system in the city of Rochester, under the franchise granted by the Common Council in April, was heard. Quite a number of prominent lawyers were present, including all of the members of the firm of Satterlee, Yeoman & Taylor, attorneys for the Home company, also Mr. Barhite, Judge John D. Lynn, who opposes the instituting of the new system on the ground of danger to the public, and Corporation Counsel Kinney. Judge Yeoman was heard first. He stated that the grounds of the demurrer were:

First—That the plaintiff cannot as a taxpayer maintain the cause of action set forth in the complaint and has not legal capacity to sue as a taxpayer on such cause of action.

Second—That the complaint does not state facts sufficient to constitute a cause of action against said defendant, the Home Telephone company of Rochester, N. Y.

The complaint includes the city as one of the defendants, and the corporation counsel's argument was briefly confined to the contention that the city was not properly a defendant.

In referring to the grounds for the demurrer Judge Yeoman said that the city had not disposed of any property in granting the franchise, as the Common Council did not possess the power to give the telephone company permission to use the streets; that the streets were under state jurisdiction, and that Mr. Barhite had not, therefore, a cause of action as a taxpayer. Judge Kinney affirmed the contention with the statement that streets deeded to the city were not for all time, but that it was a form of easement.

Continuing, Judge Yeoman stated that the Common Council, in entering into the contract or franchise, did not waste public money, that it did not remunerate the telephone company, and that, as a matter of fact, the benefits which were derived were in favor of the city. The streets, he said, were the property of the state, and the state gave the corporation permission to operate in the streets, subject to such restrictions as might be made by the city authorities. He referred to a decision of the Appellate Court, which ruled that the city of Utica could not compel a telephone company to vacate the streets; it could compel it to place its wires underground; but not compel their absolute removal. Authorities to sustain the demurrer were cited in large numbers.

John Barhite argued against the demurrer. He said that there could be no question but that the conveyance of a right to operate a telephone system was the conveyance of a property right. The last Legislature, in passing the so-called Ford bill, he said, had denominated a franchise as property which is subject to taxation. The papers in the matter were left with Justice Dunwell. O. E. D.

Standardization of Electrical Apparatus.

[*Continued from page 20.*]

the required full-load values, the condition of full load being considered in all cases as the normal condition of operation.

44. The regulation of an apparatus intended for the generation of a potential, current, speed, etc., varying in a definite manner between full load and no load, is to be measured by the maximum variation of potential, current, speed, etc., from the satisfied condition, under such constant constant conditions of operation as give the required full-load values.

If the manner in which the variation in potential, current, speed, etc., between full load and no load is not specified, it should be assumed to be a simple linear relation, i. e., undergoing uniform variation between full load and no load.

The regulation of an apparatus may, therefore, differ according to its qualification for use. Thus the regulation of a compound-wound generator specified as a constant-potential generator will be different from that it possesses when specified as an over-compounded generator.

45. The regulation is given in percentage of the full-load value of potential, current, speed, etc., and the apparatus should be steadily operated during the test, under the same conditions as at full load.

46. The regulation of generators is to be determined at constant speed; of alternating apparatus at constant impressed frequency.

47. The regulation of a generator-unit, consisting of a generator united with a prime mover, should be determined at constant conditions of the prime mover, i. e., constant steam pressure, head, etc. It would include the inherent speed variations of the prime mover. For this reason the regulation of a generator-unit is to be distinguished from the regulation of either the prime mover or of the generator contained in it, when taken separately.

48. In apparatus generating, transforming or transmitting alternating currents, regulation should be understood to refer to non-inductive load; that is, to a load in which the current is in phase with the electromotive force at the output side of the apparatus, except where expressly specified otherwise.

49. In alternating apparatus receiving electric power, regulation should refer to a sine wave of electromotive force, except where expressly specified otherwise.

50. In commutating machines, rectifying machines and synchronous machines, as direct-current generators and motors, alternating-current and polyphase generators, the regulation is to be determined under the following conditions:

a. At constant excitation, in separately excited fields.

b. With constant resistance, in shunt-field circuits, and

c. With constant-resistance shunting-series fields; i. e., the field adjustment should remain constant, and should be so chosen as to give the required full-load voltage at full-load current.

51. In constant-potential machines, the regulation is the ratio of the maximum difference of terminal voltage from the rated full-load value (occurring within the range from full load to open circuit) to the full-load terminal voltage.

52. In constant-current machines, the regulation is the ratio of the maximum difference of current from the rated full-load value (occurring within the range from full-load to short circuit), to the full-load current.

53. In constant-power machines, the regulation is the ratio of maximum difference of power from the rated full-load value (occurring within the range of operation specified) to the rated power.

54. In over-compounded machines, the regulation is the ratio of the maximum difference in voltage from a straight line connecting the no-load and full-load values of terminal voltage as function of the current, to the full-load terminal voltage.

55. In constant-speed, continuous-current motors the regulation is the ratio of the maximum variation of speed from its full-load value (occurring within the range from full-load to no-load) to the full-load speed.

56. In transformers the regulation is the ratio of the rise of secondary terminal voltage from full-load to no-load (at constant primary impressed terminal voltage), to the secondary terminal voltage.

57. In induction motors, the regulation is the ratio of the rise of speed from full-load to no-load (at constant impressed voltage), to the full-load speed.

The regulation of an induction motor is, therefore, not identical with the slip of the motor, which is the ratio of the drop in speed from synchronism to the synchronous speed.

58. In converters, dynamotors, motor-generators and frequency-changers, the regulation is the ratio of the maximum difference of terminal voltage at the output side from the rated full-load voltage (at constant impressed voltage and at constant frequency), to the full-load voltage on the output side.

59. In transmission lines, feeders, etc., the regulation is the ratio of maximum voltage difference at the receiving end, between no-load and full non-inductive load, to the full-load voltage at the receiving end, with constant voltage impressed upon the sending end.

60. In steam engines, the regulation is the ratio of the maximum variation of speed in passing from full-load to no-load (at constant steam pressure at the throttle), to the full-load speed.

61. In a turbine or other water-motor, the regulation is the ratio of the maximum variation of speed from full-load to no-load (at constant head of water; i. e., at constant difference of level between tailrace and headrace), to the full-load speed.

Variation and Pulsation.

62. In prime movers which do not give an absolutely uniform rate of rotation or speed, as in steam engines, the "variation" is the maximum angular displacement in position of the revolving member expressed in degrees from the position it would occupy with uniform rotation, and with one revolution as 360°; and the pulsation is the ratio of the maximum change of speed in an engine cycle to the average speed.

63. In alternators or alternating-current circuits in general, the variation is the maximum difference in phase of the generated wave of electromotive force from a wave of absolutely constant frequency, expressed in degrees, and is due to the variation of the prime mover. The pulsation is the ratio of the maximum change of frequency during an engine cycle to the average frequency.

64. If n = number of poles, the variation of an alternator is $\frac{n}{2}$ times the variation of its prime mover if direct-connected, and $\frac{n}{2} p$ times the variation of the prime mover, if rigidly connected thereto in the velocity ratio p.

65. The pulsation of an alternating-current circuit is the same as the pulsation of the prime mover of its alternator.

Rating.

66. Both electrical and mechanical power should be expressed in kilowatts, except when otherwise specified. Alternating-current apparatus should be rated in kilowatts on the basis of non-inductive condition, i. e., with the current in phase with the terminal voltage.

67. Thus the electric power generated by an alternating-current apparatus equals its rating only at non-inductive load; that is, when the current is in phase with the terminal voltage.

68. Apparent power should be expressed in kilovolt-amperes, as distinguished from real power in kilowatts.

69. If a power-factor other than 100 per cent. is specified, the rating should be expressed in kilovolt-amperes and power-factor, at full load.

70. The full-load current of an electric generator is that current which with the rated full-load terminal voltage gives the rated kilowatts, but in alternating-current apparatus only at non-inductive load.

71. Thus, in machines in which the full-load voltage differs from the no-load voltage, the full-load current should refer to the former.

If P = rating of an electric generator and E = full-load terminal voltage, the full-load current is:

$I = \frac{P}{E}$ in a continuous-current machine or single-phase alternator.

$I = \frac{P}{E\sqrt{3}}$ in a three-phase alternator.

$I = \frac{P}{2E}$ in a quarter-phase alternator.

72. Constant-current machines, such as series arc-light generators, should be rated in kilowatts, based on terminal volts and amperes at full load.

73. The rating of a fuse or circuit-breaker should be the current strength at which it will open the circuit, and not the working-current strength.

Classification of Voltages and Frequencies.

74. In direct-current, low-tension generators, the following average terminal voltages are in general use and are recommended: 125 volts, 250 volts, 550 volts.

75. In direct-current and alternating-current low-pressure circuits, the following average terminal voltages are in general use, and are recommended: 110 volts, 220 volts.

In direct-current power circuits, for railway and other service, 500 volts may be considered as standard.

76. In alternating-current, high-pressure circuits at the receiving end, the following pressures are in general use and are recommended: 1,000 volts, 2,000 volts, 3,000 volts, 6,000 volts, 10,000 volts, 15,000 volts, 20,000 volts.

77. In alternating-current high-pressure generators, or generating systems, the following terminal voltages are in general use, and are recommended: 1,150 volts, 2,300 volts, 3,450 volts.

These pressures allow of a maximum drop in transmission of 15 per cent. of the pressure at the receiving end. If the drop required is greater than 15 per cent., the generator should be considered as special.

78. In alternating-current circuits, the following approximate frequencies are recommended as desirable:

25 ~ or 30 ~ 40 ~ 60 ~ 120 ~ (

These frequencies are already in extensive use, and it is deemed advisable to adhere to them as closely as possible.

Overload Capacities.

79. All guarantees on heating, regulation, sparking, etc., should apply to the rated load, except where expressly specified otherwise, and in alternating-current apparatus to the current in phase with the terminal electromotive force, except where a phase displacement is inherent in the apparatus.

80. All apparatus should be able to carry a reasonable overload without self-destruction by heating, sparking, mechanical weakness, etc., and with an increase of temperature elevation not exceeding 15° C. above those specified for full loads. See sections 25 to 31.

81. Overload guarantees should refer to normal conditions of operation regarding speed, frequency, voltage, etc., and to non-inductive conditions in alternating apparatus, except where a phase displacement is inherent in the apparatus.

82. The following overload capacities are recommended:

First—In direct-current generators and alternating-current generators, 25 per cent. for one-half hour.

Second—In direct-current motors and synchronous motors, 25 per cent. for one-half hour, 50 per cent. for one minute; except in railway motors and other apparatus intended for intermittent service.

Third—Induction motors, 25 per cent. for one-half hour, 50 per cent. for one minute.

Fourth—Synchronous converters, 50 per cent. for one-half hour.

Fifth—Transformers, 25 per cent. for one-half hour, except in transformers connected to apparatus for which a different overload is guaranteed, in which case the same guarantees shall apply for the transformers as for the apparatus connected thereto.

Sixth—Exciters of alternators and other synchronous machines, 10 per cent more overload than is required for the excitation of the synchronous machine at its guaranteed overload, and for the same period of time.

APPENDIX I.

Efficiency.

Efficiency of Phase-displacing Apparatus.

In apparatus producing phase displacement, as, for example, synchronous compensators, exciters of induction generators, reactive coils, condensers, polarization cells, etc., the efficiency should be understood to be the ratio of the volt-ampere activity to the volt-ampere activity, plus power loss.

The efficiency may be calculated by determining the losses individually, adding to them the volt-ampere activity, and then dividing the volt-ampere activity by the sum.

First—In synchronous compensators and exciters of induction generators, the determination of losses is the same as in other synchronous machines under sections 10 and 11.

Second—In reactive coils the losses are molecular friction, eddy losses and $I^2 r$ loss. They should be measured by wattmeter. The efficiency of reactive coils should be determined with a sine wave of impressed electromotive force, except where expressly specified otherwise.

Third—In condensers, the losses are due to dielectric hysteresis and leakage, and should be determined by wattmeter, with a sine wave of electromotive force.

Fourth—In polarization cells, the losses are those due to electric resistivity and a loss in the electrolyte of the nature of chemical hysteresis, and are usually very considerable. They depend upon the frequency, voltage and temperature, and should be determined with a sine wave of impressed electromotive force, except where expressly specified otherwise.

APPENDIX II.

Apparent Efficiency.

In apparatus in which a phase displacement is inherent to their operation, apparent efficiency should be understood as the ratio of net power output to volt-ampere input.

Such apparatus comprise induction motors, reactive synchronous converters, synchronous converters controlling the voltage of an alternating-current system, self-exciting synchronous motors, potential regulators and open-magnetic circuit transformers, etc.

Since the apparent efficiency of apparatus generating electric power depends upon the power factor of the load, the apparent efficiency, unless otherwise specified, should be referred to a load-power factor of unity.

APPENDIX III.

Power Factor and Inductance Factor.

The power factor in alternating circuits or apparatus may be defined as the ratio of the electric power, in watts, to volt-amperes.

The inductance factor is to be considered as the ratio of wattless volt-amperes to total volt-amperes.

Thus, if p = power factor, q = inductance factor, then $p^2 + q^2 = 1$

The power factor is the

$$\frac{\text{(energy component of current or electromotive force)}}{\text{(total current or electromotive force)}}$$

and the inductance factor is the

1. The frequency of 120 ~ may be considered as covering the already existing commercial frequencies between 120 ~ and 140 ~, and the frequency of 60 ~ as covering the already existing commercial frequencies between 60 ~ and 70 ~.

(wattless component of current or electromotive force)
(total current or electromotive force)

true power
= volt-amperes.

Since the power factor of apparatus supplying electric power depends upon the power factor of the load, the power factor of the load should be considered as unity, unless otherwise specified.

APPENDIX IV.

The following notation is recommended:

E *e*, voltage, electromotive force, potential difference.
I, *i*, current.
P, power.
Φ magnetic flux.
$\mathfrak{B}$ magnetic density.
R, *r*, resistance.
X, *x*, reactance.
Z, *z*, impedance.
L, *l*, Inductance.
C, *c*, capacity.

Vector quantities, when used, should be denoted by capital italics.

APPENDIX V.

Table of sparking distances in air between opposed sharp needle-points, for various effective sinusoidal voltages, in inches and in centimeters:

Kilovolts Sq. Root of Mean Square.	Distance. Inches.	Cms.	Kilovolts Sq. Root of Mean Square.	Distance Inches.	Cms.
5	0.225	0.57	60	4.65	11.8
10	0 47	1.19	70	5.85	14.9
15	0 725	1.84	80	7.1	18.0
20	1.0	2.54	90	8.35	21 2
25	1.3	3.3	100	9 6	24.4
30	1.625	4.1	110	10.75	27.3
35	2 0	5 1	120	11.85	30.1
40	2.45	6.2	130	12.95	32.9
45	2.95	7.5	140	13 95	35.4
50	3 55	9.0	150	15 0	38.1

Standards of Light.

At the recent general meeting of the American Institute of Electrical Engineers two brief papers on the subject of light standards were presented by Messrs. Doane and Fessenden. The subject is viewed from different points by the two writers, but both indicate the need of improvement in methods of photometry.

Plea for a Working Standard of Light.

BY S. EVERETT DOANE.

It was my desire to present what I am about to say as a part of the discussion on the report of the committee on the standard of light. As this committee will not report at this meeting, I bring the following before the Institute with no intention, of course, of interfering with the work our committee is doing. We all agree as to the importance of this work. What I wish to propose is that this committee or a new one fix definitely the means for maintaining a working standard of light pending, the adoption of a primary one.

There are scattered over the country many well equipped laboratories, and in the near future every central station and large isolated plant will be provided with means for measuring light. There is not now in existence any workable primary standard which can be used by the ordinary photometer corps.

It may be said that this is equally true of all primary standards. The mercury column or resistance standard, in fact, presents so many difficulties that it is rarely ever used, even in our best equipped laboratories. In reply we can say that the standard of light differs from all these in that its terms are so indefinite and so crudely outlined that two laboratories cannot produce the same value for the candle power if they work entirely independently. The discussion on this paper will probably bring out very diverse views as to what is the proper direction in which to work to eliminate our present difficulties with the light standard.

The standard of light is in quite another class from the other standards. Every instrument-maker is anxious that his instruments shall be calibrated in true units, and he can so calibrate them if he uses care. He sends his instruments out so calibrated to the best of his knowledge.

A lamp user may say to the manufacturer, "Your standard is wrong," and neither ever dreams of suggesting a recalibration; they know by experience that an agreement cannot be reached. No observer can even duplicate his own work. What is the result? Every lamp-maker in the country is sending out some lamps which are wrongly marked, according to his own standards, because some of his customers have standards of their own.

Lamp-makers differ among themselves, and there exists no way by which they can be brought together. It is obviously to the interest of the whole electrical engineering fraternity that some action looking to the correction of this condition be inaugurated.

In passing I wish to go on record as saying that in a very few years the incandescent lamp will be adopted as a primary standard. It could be so adopted to-day if lamp-makers would only tell what they know.

Every committee (our committee included) ever having to do with investigation of proposed light standards has found an incandescent electric lamp a very convenient secondary standard. It has been entirely satisfactory, so much so that my whole purpose in writing this paper has been to see if we cannot inaugurate some action which will result in the appointment of a committee who will provide means whereby a standard of light may be arbitrarily maintained. This committee could send out, under proper restrictions, properly seasoned and calibrated incandescent lamps for this purpose.

It does not matter just how this is done. Possibly a national laboratory could be founded. A committee of the professors of electrical engineering from our various colleges might agree to do this for us. Something should be done, and the first step toward it will be the appointment of an Institute committee on the maintenance of what our committee on light may decide is a proper standard value. Such a decision will be arbitrary, and may have to be changed later, but what of that? We need now a common working standard of light.

That the discussion may be entirely free, I refrain from making any definite suggestions until the views of the members may be obtained, but whatever these views may prove to be, I hope some action will be taken which will afford us temporary relief and enable our committee on light standard to pursue its work unhindered by the necessity for hasty action. We can take action none too soon. A year from now, at the rate photometers are being made, we shall have as many standards of light as Joseph's coat had colors, unless something be done.

Light Standards.

BY REGINDALD A. FESSENDEN.

In previous communications[1] by the writer the following were suggested:

1. A standard of radiation.

2. A standard of light (to be used as primary standard), which need not be accurate to much within one-half per cent., in view of the great difference between the eyes of different observers in regard to visibility of light of different wave lengths.

3. A secondary standard of light, consisting of electric incandescent lamps of 16 candle power, the filaments being placed in bulbs of exceptionally good vacua and of the size used for 100 candle power.

Since the publication of the above the following points have been noted: That as the yellowish-green part of the spectrum seems to be the most constant in physiological effect, the standard of luminous effect should be one watt of light of this wave length.

That the blackened-copper ball suggested by the writer as a standard of radiation does not give a perfectly uniform distribution of radiation; or, rather, that the presence of convection currents in the air interferes with the uniform distribution of the radiation, as one part of the ball is thus rendered slightly hotter than another. This might be obviated by placing in vacua, but other difficulties are thus introduced. The solution finally adopted is that of having a plane surface of copper of large extent, blackened with platinum black to a fixed degree determined by the current passed. This method of coating with platinum black was first suggested by Lummer and Kurlbaum, and with wires placed within the copper slab of such resistance and carrying such current that .01 watt is radiated per square centimeter of surface of the slab; the slab to be one meter in diameter, of circular section, one centimeter in thickness, and its back and sides covered with a layer of three centimeters of eiderdown; the slab to be supported in a horizontal plane, and face downwards, and with rim around it. Under these conditions, it has been ascertained from preliminary experiments on a disk of smaller size, convection currents play a small part, and the radiation to a point placed 10 centimeters from the face of the plate is very closely the theoretical amount.

In use with this standard the balance thermopile described by the writer in a previous communication must have its faces at right angles, like the letter L, and be reversible, as before.

As regards the acetylene standard, in view of the fact that the Western University of Pennsylvania has not seen fit to make any appropriations for scientific work during the last five years, and the writer's personal means have been taken up in working along a different line, but little further has been accomplished. The two-jet burner described by the writer has been generally adopted in commercial acetylene lighting, with, however, one modification, which should be avoided, i. e., the introduction of holes in the tips for leading in air. If the pressure is high, as recommended originally, and the tips are of platinum or platinum iridium, preferably blackened, the tips never get hot enough to decompose the acetylene and form benzine, and no smoke is produced. If it were found desirable to lose less pressure the tips might be artificially cooled, but the writer believes the high pressure best.

A certificate of incorporation for the Lyons (N. Y.) Electric company has been filed. The capital stock is $5,000, divided into 100 shares of $50 each, for a term of 50 years. The directors are as follows: S. E. Bishop, Clyde; A. B. Bishop, Clyde; E. S. Bishop, Rhiedack; C. N. Towlerton, Lyons; Calvin Hotchkiss, Lyons; James Bashford, Lyons, and Clyde W. Knapp, Lyons.

1. Transactions A. I. E. E., vol. xi., p. 110; vol. xii., p. 500; vol. xiii., p 201.

Attendance at the Institute Meeting in Boston.

Following is the list of the names of the participants in the general meeting of the American Institute of Electrical Engineers in Boston last week. A number of ladies accompanied the gentlemen named:

Adams, C. A. ..... Cambridge, Mass.
Aldrich, William S. ..... Champaign, Ill.
Ayer, James I. ..... Boston
Babson, Roger W. ..... New York
Bell, Louis ..... Boston
Berthold, V. M. ..... Needham, Mass.
Blodgett, George W. ..... Boston
Blood, John Balch ..... Boston
Brooks, Morgan ..... Lincoln, Neb.
Brophy, William ..... Boston
Burleigh, Charles W ..... Boston
Cabot, F. E. ..... Milton, Mass.
Caldwell, F. C. ..... Columbus, O.
Child, Chas. T. ..... New York
Clough, Albert L. ..... Manchester, N. H.
Codman, J. S ..... Boston
Cobo, H. B. ..... New York
Conant, R. W. ..... Boston
Craig, J. Hally ..... Boston
Doane, S. E. ..... Marlboro, Mass.
Edgar, C. L. ..... Boston
French, Thomas, Jr. ..... Cincinnati, O.
Gale, Horace B. ..... Natick, Mass
Garratt Allan V. ..... Boston
Goddard, C. M. ..... Boston
Goldsborough, W. E. ..... Lafayette, Ind.
Hadley, Fred W. ..... Arlington Heights, Mass.
Hamilton, James ..... Boston
Hammer, William J ..... New York
Herrick, Charles H ..... Boston
Hopewell, Chas. F. ..... Cambridge, Mass.
Hosmer, Sidney ..... Boston
Hunt, H. H. ..... Boston
Hutchinson, Cary T ..... New York
Jackson Dugald C. ..... Madison, Wis.
Kemp, H., Jr. ..... Lynn
Kennelly, A. E. ..... Philadelphia
Knight, A. S. ..... Boston
Labouisse, John P. ..... Lynn, Mass.
Latham, H. M. ..... Boston
Leonard, H. Ward ..... New York
Lisle, Arthur B. ..... Providence, R. I.
Lockwood, Thomas D. ..... Boston
Lonsdale, John Ellis ..... Providence, R. I.
Matthews, C. P. ..... Lafayette, Ind.
Moses, Percival R. ..... New York
Pope, Ralp W. ..... Elizabeth, N. J.
Puffer, William L. ..... Boston
Rice, C. W. ..... New York
Richards, C. W ..... Boston
Roberts, Thomas M. ..... Boston
Ryan, Harris J. ..... Ithaca, N. Y.
See, A. B ..... Brooklyn
Sever, G. F. ..... New York
Sheldon, Samuel ..... Brooklyn
Smith, Wm. Lincoln ..... Concord, Mass.
Sohmann, R. W. ..... Oakland, Cal.
Spauldiog, H. C ..... Boston
Sperry, Elmer A ..... Cleveland, O.
Stearns, Charles K. ..... Boston
Steinmetz, Charles P. ..... Schenectady, N. Y.
Stine, W. M. ..... Swarthmore, Pa.
Storrs, H. A. ..... Burlington, Vt.
Thomson, Elihu ..... Swampscott, Mass.
Treat, G. W. ..... New York
Wallace, Charles F. ..... Boston
Waller, H. W. ..... Montreal
Whiting, S. E. ..... Cambridge
Williams, Arthur ..... New York
Witherell, Percy W. ..... Boston
Woodle, Leopold ..... New York
Woodward, William C. ..... Providence, R I.

Electricity in the Washington Postoffice.

Electricity will play an important part in the operation of the new city postoffice which the government has just erected in Washington, D. C., at the cost of several million dollars. In fact, in this modern building, electricity is called to play an almost exclusive part, both in lighting and ventilation.

The engine equipment consists of four Buckeye horizontal tandem-compound engines, supplied with steam through eight-inch and 10-inch duplicate steam mains, provided with combined receiver and steam separators, delivering steam at about 100 pounds pressure. The engines turn at about 275 revolutions a minute, developing 150 horse power each, or a total of 600 horse power. They are connected directly to the shafts of four 100-kilowatt Thresher generators, each having capacity for 2,000 16 candle power incandescent lamps. Both engines and generators, however, are calculated for an overload of at least 25 per cent. for a period of several hours, if called upon by any emergency.

The switchboard is of marble and contains a very complete outfit of instruments, switches and rheostats. On each floor smaller distribution tablets control groups of lights.

Throughout the building the ventilating fans are to be driven by motors operated by the current furnished by the plant, while the canceling machines, each capable of canceling from 20,000 to 25,000 letters an hour, are also electrically operated. There are at present seven of these machines in operation in the building.

Three electric elevators, designed to be operated variously from the second to the ninth floors, will also obtain their current from the plant. The melting of the large quantities of sealing wax used in the registry and other departments will also be performed by some satisfactory form of electric heater. The wiring of the building is run in steel conduits, buried in the floors or concealed in the walls of the building, and there has been used over 200,000 feet of conduits for this purpose.

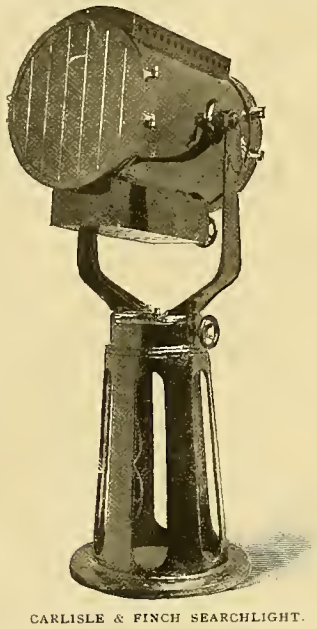
The combination gas and electric-light fixtures in the building are by far the handsomest furnished any public building in the country, being specially designed to accord with the architectural features of the building. The handsome main screen in the first-floor corridor contains 101 three-light opalescent bullseyes to assist in the illumination of the public corridor. A. F. T.

Carlisle & Finch Searchlight.

A new type of searchlight, illustrated herewith, is being placed on the market by the Carlisle & Finch company of Cincinnati. It is what is known as the "deck type." It is usually placed on the forward deck of the steamer, and is of such height as to be conveniently handled by the person operating it. The total height of the projector is about five feet. Handles are attached for convenience. All the marine projectors of this company are fitted with improved glass mirrors which throw the straightest possible beam of light. Objects two or three miles distant are rendered plainly visible on the darkest night.

In addition to the "deck type" this company also makes all the standard forms of searchlights and marine projectors. The form of projector designed to be placed on the pilot-house of vessels is simple and effective. It renders the control of the light so accurate and easy that, by a turn of the wrist, the pilot can direct the light to any part of the horizon or elevate and depress it vertically. It is claimed that fully 90 per cent. of the searchlights used on the western rivers are made by the Carlisle & Finch company. It is stated that no other make of searchlight has been placed on an Ohio River steamer during the last two years.

Recognizing the demand for a small and compact searchlight, this company has brought out a nine-inch projector which weighs but 35 pounds complete. Like all its other projectors, it is finished in a variety of styles, from japanned iron to polished brass. Some of the finest yachts on the lakes are equipped with projectors of this size. The Carlisle & Finch company also makes a line of small acetylene searchlights for use on small launches and



CARLISLE & FINCH SEARCHLIGHT.

yachts where it is not possible to have an electric-light plant. While not possessing the great power of an electric searchlight, the light is of sufficient power to pick out buoys and other objects at 800 to 1,000 feet distance.

Meysenburg & Badt are the Chicago representatives of the Carlisle & Finch company, and they will be pleased to furnish catalogues and all other information.

The Nernst Lamp.

At the meeting in London, on June 21st, of the "Nernst Electric Light, Limited," which has the rights of the new Nernst lamp for Asia, Africa, Australasia and South America, some interesting statements were made, although it is evident that the commercial exploitation of the new form of electric light is still some distance in the future.

The chairman of the company, Sir Henry C. Mance, said: "We have been fortunate enough to secure the services of Dr. von Recklinghausen, who has worked for a considerable time with Professor Nernst, and therefore we have the best and most competent man we could possibly find to assist us in the development of the lamp. We set carefully to work to make ourselves thoroughly familiar with the lamp by a long series of experiments, in order to test the life of the filaments and decide upon the most suitable sizes of the lamp for market purposes. When this company was first started it was believed that the chief use of the Nernst lamp would be for street lighting, but, as a result of our experiments during the last two or three months, we find that we can look forward to introducing the light for extensive use indoors. When we commenced operations it was expected that we should be chiefly competing for outdoor work, but I do not think there is a more elegant lamp than the Nernst on the market at the present time, and I have every confidence that it will be extensively used indoors. We have a lamp also which can be used for military purposes. The smallest lamp we have made is a 10 candle power lamp, and the consumption of current of the Nernst is just less than one-half the amount used by the present Ediswan lamps. * * * * We have not yet decided as to whether we shall manufacture in this country or in Holland."

Mr. B. M. Drake, the managing director, is an electrical engineer. He stated that when he took office the lamp could only be automatically heated in 30 seconds, whereas at the present time it could be done in six seconds, which, of course, was a great improvement. As a practical engineer, he had no hesitation in saying that the Nernst lamp was good enough to cut out the ordinary carbon incandescent lamps. They now possessed a lamp able to work at 1½ watts per candle power which would last 500 hours, and which could be automatically lighted in six seconds; in fact, it gave some light immediately.

A stockholder asked what the cost of manufacturing the lamp would be, and the chairman answered that it would be about one shilling.

Mr. James Swinburne, the consulting engineer, did not like the criticisms of the lamp that have appeared in the English technical press, and he said so. He originally considered that the immediate future for the company, as far as profit-making was concerned, would be in selling large lamps to take the place of arc lamps, but since then so much progress had been made in the smaller lamps that he felt the latter was in a very much better position than it was originally. At the same time it must be remembered that the company had to deal with foreign countries where high pressures and large lights would probably be in very great demand, much more so than in this country. As regarded the policy of the company, he thought the shareholders ought to be patient. It might be possible to sell lamps this autumn, but he felt it would be much wiser to rely on the following autumn. The worst thing the company could do would be to send out lamps that were imperfect or caused any sort of failure, and the next worst thing was to be overwhelmed with orders which it could not fill.

Detroit Street-railway Ownership Plan Declared Unconstitutional.

After all the trouble and wrangling about the plan to buy the street railways of Detroit for the municipality through a commission appointed for the purpose, the Supreme Court of Michigan has unanimously decided that the whole project is unconstitutional in any form. The opinion, written by Justice Moore, was made public on July 5th, and declared the act passed last winter providing for the municipal ownership of street railways in Detroit, and creating a commission to acquire and operate the system, to be unconstitutional and void. The decision turns entirely on the proposition that the law is in contravention of the constitutional provision that "the state shall not be party to or interested in any work of internal improvement, nor engaged in carrying on such work, except in the expenditure of grants to the state of lands or other property."

If the enabling act had been held to be constitutional, it is very doubtful whether the proposed change in ownership could have been arranged. As it is, the decision has effectually placed a quietus on the movement.

Through Sleepers to Boston.

The Wabash Continental Limited, leaving Chicago 12:02 noon, arriving in Boston 5:50 p. m. next day, carries through sleepers to Boston; also the night express, leaving Chicago 11:00 p. m., arriving in Boston 10:20 a. m. second day. There are through sleepers to New York on both trains. Ticket office, 97 Adams street, Chicago. Telephone, Main 1619.

CORRESPONDENCE.

New York Notes.

New York, July 3.—Will the street-railway and electric-lighting interests of the boroughs of Manhattan and Brooklyn be consolidated into a gigantic monopoly? That is the question that men are now asking themselves, and there are not lacking evidences pointing to an affirmative answer. There is little doubt that negotiations for the combination of the surface and elevated-railway systems of the Manhattan and Metropolitan companies of New York and the Rapid Transit company of Brooklyn have been in progress for some time, and last week it was freely stated that the deal would go through and that the Third avenue system was to be included. If this consolidation is effected, it will mean also a combination, with possibly one exception, of all the larger electric-light companies in New York and Brooklyn. In the lighting field the consolidation process has been going on for some time on both sides of the river, and as the relations of the New York Gas and Electric Light, Heat and Power company to the Metropolitan Street Railway company, and of the Kings County Electric Light and Power company to the Brooklyn Rapid Transit company, are well known, it follows that a consolidation of the railway companies will mean a practical unification of the electric-lighting interests of this great city. But the combination has not been made yet, and it may not be, although many Wall street prophets predict it with confidence. There seems to be a large element of doubt about the attitude of the Third Avenue company, and it is to be remembered that that company has a working traffic agreement with the Manhattan Elevated people. Then there is the one electric-light company that I referred to above as holding aloof from the "crowd." That is the United Electric Light and Power company of Manhattan. The United company was until lately the representative Westinghouse central-station company in this city, but new owners are now in control, as I stated last week, and the mere "looker-on in Venice" hardly knows where to place it. One statement is that Standard Oil interests are now predominant in this company. Old Russell Sage, too, scoffs at the reported combination, but although he is a large owner of Manhattan stock he is very conservative and is not believed to be in touch with the younger and more progressive element. All the railway companies named are planning or making great electrical extensions, at a cost of many millions of dollars; and no doubt by an intelligent combination of their resources and business a great saving could be effected.

The papers report the successful use of the large electro-magnet arranged for eye surgery in the Manhattan Eye and Ear Hospital. A bit of steel was imbedded in the eyeball of a patient so deeply that it could not be seen, and the wound it made had closed behind it, but had not had time to grow together. When the steel first felt the magnetic attraction it encountered considerable resistance from the flesh, through which it was dragged slowly and with much pain to the patient. The instant it drew clear of the eyeball it leaped to the magnet.

William H. Rieger, a taxpayer, has brought suit against the Metropolitan Street Railway company to prevent it from using its electrical conduits for any other purpose than to enclose electrical conductors to furnish current for moving and lighting its own cars. Mr. Rieger's counsel say that great loss will accrue to the taxpayers, from the lack of compensation for the privilege, if the Metropolitan company is allowed to lease the right to use its conduits for commercial power and light purposes. It is asserted that Mr. Rieger is acting in the interest of some corporation not named in the complaint.

The Manhattan Railway company has secured a location for its power house at Seventy-fourth and Seventy-fifth streets and the East River. The plot has a frontage of 204 feet on the river by 570 feet on the side streets, enough space to install the power for the elevated system and allow for an increase in growth of 50 per cent. The contract for 9,000 tons of third rail, weighing 100 pounds per yard, has been given to the Lackawanna Steel company. The delivery and installation will be begun in September. Competitive bids have been received from engine builders and boiler makers, and are now under consideration. The new power house will be only a mile south of the large generating plant of the Metropolitan Street Railway company.

Three certificates of merger, completing the deal whereby the New York and Queens Gas and Electric company absorbed the New York and Queens Light and Power company, the Newtown Light and Power company and the Flushing Gas and Electric Light company, were filed with the Queens County clerk at Jamaica last week. The New York and Queens Gas and Electric company purchased outright all of the stock of the different companies named, and to comply with the law it became necessary for the directors of the several companies to file their consent thereto in order to complete the transfer. M. S.

PERSONAL.

General Leonard Wood has declined the offer of the presidency of the Washington Traction and Electric company and will remain in the army.

ELECTRIC LIGHTING.

The election for bonding the town of Ukiah, Cal., for an electric-lighting system took place last month, and was carried by a vote of 319 for the bonds and only 65 against.

The War Department has awarded to J. F. Buchanan & Co. of Philadelphia, Pa., the contract for the installation of an electric-light plant at Fort Sumter, S. C., at $1,865, and for a similar plant at St. Helena, S. C., for the sum of $2,045.

The Montgomery Water Power company was organized last month in Jersey City with a capital stock of $600,000. The incorporators are Charles W. King, William Clarke and R. Vanderhoof of Jersey City, but these are only agents for the real capitalists. The company intends to establish electric-light and power plants all over the South, especially in Alabama. The electricity is to be generated by water power.

New York and Philadelphia capitalists, negotiating through Brown Brothers & Co., have secured control of the Harrisburg (Pa.) Electric company. A new company, to be chartered July 14th as the Harrisburg Light, Heat and Power company, will take the place of the Harrisburg Electric company, but there will be no change in the officers of the company. The incorporators of the new company are E. Z. Wallower, president of the present company; W. O. Bishop, H. Cohen, T. H. Heist, E. B. Mitchell, Benjamin M. Nead, H. C. Ross, Joseph Strouse and H. J. Stewart. The new company will be bonded for $1,000,000 and will issue stock to the amount of $1,000,000 more. One improvement to be com-

pleted is the installation of a new unit of power of 6,000 incandescent lights' capacity at the Ninth street plant. There will be a new 750 horse power engine and two 210-kilowatt generators, with rope transmission to the present line of shafting. This will greatly increase the capacity of the plant.

ELECTRIC RAILWAYS.

Electric railways now building or projected make safe the assertion that Chicago and Detroit will soon be connected by electric lines.

The Rochester Railway company has made arrangements to secure additional power from stations of the Rochester Gas and Electric company. It is said that the company may reduce the fare from Rochester to Charlotte to five cents to compete with the New York Central Railroad company.

At a meeting on June 29th of the trustees of the Massachusetts Electric Companies, the new consolidation which has recently absorbed a large number of street railways in Eastern Massachusetts, the following-named officers were elected: President, Amos F. Breed; vice-president, Charles E. Cotting; secretary, Everett W. Burdett; treasurer, J. H. Goodspeed; executive committee, Gordon Abbott, Charles Francis Adams 2d, E. N. Foss, Percy Parker, Philip L. Saltonstall. The general manager is P. F. Sullivan.

The Boston Elevated Railway company is cast-welding some of its track joints. On the Everett division of the surface road each night there is in use a welding outfit, comprising a blower, a furnace, molds and a grinder for smoothing the rail when the welding is complete. This process does away with joints, except at intervals of about 400 feet, and is found to work very well, reducing the jolting and consequent wear and tear on rolling stock to a minimum, while at the same time enhancing the comfort of passengers.

The Pasadena (Cal.) street-railway system is to be improved this summer. The electric company is already making preparations for the extension and improvement of several of its lines, the most important of which is the electrical equipment of the Illinois street road to Moline avenue. This line will be entirely taken up and relaid with heavier rails from its beginning, at the corner of Raymond avenue and Chestnut street, to Moline avenue, and on to Lake street. Later it is intended to extend it to Hill street, where it will connect with the Hill and Colorado street line, and thus make a loop.

By an injunction issued on June 29th by Judge Brentano, the Chicago City Railway company is restrained from attaching to the structure of the Union Loop its wires for the conveyance of electricity to surface cars. The bill was filed by the Union Elevated Railroad company and sworn to by the president of the road, Charles T. Yerkes. The defendant company has been given permission by the City Council to put up wires along its road, which is now operated by cable on Wabash avenue, so that repairs could be made in the cable plant. President Hamilton of the Chicago City company says that his company may be forced to use horses if the Loop people persist in their attitude.

AUTOMOBILES.

In Buffalo some experiments in the use of automobiles for collecting mail have been made. Mail from 40 boxes in a territory six miles in length was collected in less than one-half the time, it is said, that it takes to cover the same route with a horse and wagon. The experiment will be continued, and if it proves as great a success as anticipated a number of automobiles will be placed in regular commission in connection with the postal service.

TELEGRAPH.

Chicago city officials are discussing the advisability of taxing all telegraph poles within the city limits. This is a favorite way of increasing the revenue in other cities, the tax ranging from $1 to $5 a pole. Corporation Counsel Walker is quoted as follows: "While the city cannot wholly exclude the telegraph companies from entering the city, still the city may exercise any reasonable control over the manner of placing poles and stringing wires, and may, if it so desires, compel them to place their wires underground and may charge a reasonable license fee."

The twelfth annual convention of the Train Dispatchers' association of America was held at the Plankinton House, Milwaukee, on June 20th. Atlanta, Ga., was chosen as the next place of meeting, and June 14, 1900, as the date. The following-named officers were elected: President, F. N. Shultz, Garrett, Ind.; vice-president, J. R. Lusk, Mahoningtown, Pa.; executive committee, L. E. McCabe, Fort Worth, Texas; William M. Goodwin, London, Ont.; S. H. Brown, Kansas City, Kan.; F. S. James, Cherokee, Ia.

PUBLICATIONS.

The Street Railway Journal is issuing a weekly news edition, to supplement its monthly, between the intervals of publication.

Recent catalogue sheets of Charles Wirt & Co. of Philadelphia relate to rheostats and theater dimmers, to which the firm pays particular attention.

The Petite alternating-current enclosed long-burning arc lamps are very clearly described in a recent catalogue of the Western Electric company. Valuable hints on the trimming and care of arc lamps are also given.

The Snider-Hughes company of Cleveland, O., makes "Pumping Machinery" the subject of its recent catalogue. The company makes a large variety of steam pumps, and its catalogue also contains much useful general information.

The installation of chloride accumulators in the Dun building, New York, is the subject of one of the latest circulars of the Electric Storage Battery company of Philadelphia. The battery in this building has a capacity of 720 ampere-hours at a one-hour rate.

The Duncan alternating-current meters of the Fort Wayne Electric Works have long been well known, and the neat new catalogue of the company ought to increase the knowledge of their merits. Three types—watt-hour, ampere-hour and lamp-hour—are made.

The Carlisle & Finch company of Cincinnati makes a specialty of searchlight projectors for lake and river boats. It issues an attractive catalogue of electric searchlights, which it makes in several styles, and also a circular describing acetylene searchlights for launches, yachts and sailing vessels that have no electric plant.

"Reciprocating Electric Pumps" is the title of a recent circular issued by the Commercial Electric company of Indianapolis. The company makes a variety of electric pumps for mines, elevators and house service, and this circular, which is attractively illustrated, tells all about them. The high economy of electrical pumping outfits usually explains their substitution for steam pumps.

POWER TRANSMISSION.

Incorporation papers for the Pacific Wave-motor company of Los Angeles, Cal., have been filed. The capital stock is $1,000,000. Subscribers to the stock are A. Lee Perley, A. R. Hamilton and Joseph Ogden. The subscribers are named as officers and directors of the company. They are all residents of Los Angeles, excepting Mr. Ogden, who lives at Redlands, Cal. The purposes of the company are to manufacture and sell motors to be run by steam, electricity, compressed air and wave power. In a general way the company will furnish power to those who need it.

The plant of the Kalamazoo River Electric company, near Allegan, Mich., is nearly completed. The transmission line, as far as the city of Kalamazoo, is finished, and it will be carried to Marshall, Mich., by August 1st. The Kalamazoo River company owns, besides the Allegan power, the power at Ceresco, and it is expected that it will be developed soon and a second electric plant installed. Already the company has more orders for power than can be supplied from its Allegan plant, and it is desired to commence the work of construction at Ceresco the coming fall, if possible, or next spring at the latest. Power for electric-railway service, as well as for light and commercial motors, will be supplied.

MISCELLANEOUS.

At the recent annual meeting of the American Society of Civil Engineers at Cape May it was decided to hold next year's convention either in Dawson City, Alaska, or in Porto Rico.

The new rolling-lift bridge at Fort Port Channel, Boston, is electrically operated. This bridge differs from Chicago rolling-lift bridges, in that the movable parts form continuous spans across the channel instead of joining in mid-stream.

TRADE NEWS.

It is stated that the number of students and graduates of the International Correspondence Schools of Scranton now amounts to 95,000.

The Manhattan General Construction company, manufacturer of the well-known Manhattan enclosed arc lamps, has removed to its new factory at Plane and Orange streets, Newark, N. J., where its general offices are also located. The Manhattan company retains a sales office, however, at the old address, No. 11 Broadway, Bowling Green building (room No. 814), New York.

Articles of incorporation of the Raritan Electrical Manufacturing company were filed in the Middlesex county clerk's office, in New Brunswick, N. J., June 28th. The company will manufacture, sell, lease and use electrical machines and tools, vacuum pumps, incandescent lamps and various electrical appliances. The capital is $150,000, divided into 150 shares. The corporators are Albert H. Gleason, Frederick N. Waltress and W. Russell Osborn of New York. The company will use the plant formerly operated by the Beacon Lamp company.

From the fact that the Siemens & Halske Electric company of America is about to engage extensively in the manufacture of electric-vehicle motors, some persons have inferred that it will abandon other forms of electrical manufacture. This view is entirely incorrect. The company will continue to manufacture electrical apparatus of all kinds—direct-current, alternating and arc machines—and all orders will receive prompt attention. The Siemens & Halske company is out for business and proposes to secure its share.

An official notice of the Underwriters' Inspection Bureau of New Orleans states that "all matters of difference between the Underwriters' Inspection Bureau and Thomas S. McLoughlin, electrical contractor of this city, have been satisfactorily adjusted. All installations heretofore made by him are approved and passed, practical experience having induced the bureau to waive its contention against his interpretation of certain rules of the bureau in respect to such of his installations as have formed the subject of contention."

Mr. E. H. Ball, general manager of the Chicago Belting company, made a business trip to the South recently in the interest of his company. His visit was eminently successful, judging from the orders he brought back. The business of this company has been increasing so rapidly of late that it has been compelled to run its factory to its utmost capacity. Mr. Ball recently secured for his company the services of B. F. Horsting, favorably known in the belt business as having been the secretary and treasurer of the old Munson Belting company and who so successfully managed the estate for the assignee when that company failed. Another man Mr. Ball secured for his company is George Conger, the man who had charge of the Chicago factory for the Munson company. The Chicago Belting company is one of Chicago's progressive concerns, and the success with which it is meeting is well merited.

BUSINESS.

The Leschen-Macomber-Whyte company of 19 and 21 South Canal street, Chicago, has a stock of about 3,500 pounds of No. 9 D. C. C. magnet wire—new goods—for which it asks an offer.

Doubtless in time the speaking-tube system will reach a stage of "innocuous desuetude" through competition of intercommunicating telephones. However, the Central Electric company, Chicago, still carries such articles in stock to meet current demands. For data upon speaking-tube supplies this company refers to its general catalogue. Concerning intercommunicating telephones it invites correspondence.

The Vindex Electric company, Chicago, owing to the rapid increase of its business, has been compelled to greatly increase its facilities for manufacturing. The company has recently nearly doubled its floor space and added much new machinery, but is nevertheless compelled to work its entire force overtime in order to take care of the orders. The company's transformer is recognized as being one of the best in the market, yet its facilities for manufacturing are such that it is able to quote low prices.

The Mona Manufacturing company, 65 West Broadway, New York, is the sole manufacturer of Trotter's Mona commutator compound, which, it is said, is used by thousands of engineers and electricians in all parts of the world. The Mona compound is an efficient lubricator for carbon, leaf or gauze-wire brushes. It is used by many of the largest and most important electric plants in the United States and Canada, and also in England, France, Russia, Germany, Italy, New Zealand, Queensland and in nearly every part of the civilized world. Engineers having charge of electric plants fully realize the importance of having and using a satisfactory commutator lubricator of high grade. A sample will be sent free to any reader of this journal by addressing Goldmark & Wallace, 121 Worth street, New York city.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 27, 1899

627,465. Telephone Index. Herbert L. Allen, Hartford, Conn. Application filed May 5, 1899.

A telephone index having a back, a number of stiff independent leaves having reinforced perforations near one edge, and a crimped wire extending through the perforations in the leaves and secured to the back.

627,471. Controller for Motors. Menard K. Bowen and George W. Knox, Chicago, Ill. Application filed November 7, 1898.

A combination with a movable controlling device of two engaging parts connected together, one adapted to normally engage the controlling device, the other adapted to be brought into engagement therewith after the controlling device has been moved a predetermined amount and prevent its further movement, and a releasing device associated therewith and adapted to release the part which prevents the movement of the controlling device, so as to permit a further movement of the same.

627,475. Electric Railway. William M. Brown, Johnstown, Pa. Application filed May 5, 1897.

An electric contact box containing a magnetically actuated circuit-closer between the top of the box and the

source of supply in combination with a magnetically actuated and independently movable circuit-opener between the top of the box and the ground side of the circuit.

627,476. Contact-box for Electric Railways. William M. Brown, Johnstown, Pa. Application filed September 30, 1898.

A metallic cover and the base form an electric cootact box; a closed vessel is withio the hox; a member secures the vessel to the cover; a terminal in connection with the source of electric supply, spring contacts secured to the hase of the vessel and engaging the terminal, and a circuit-closer within the vessel electrically connected with the spring contacts and with the member securing the vessel to the cover.

627,477. Electric Railway. William M. Brown, Johnstown, Pa. Application filed May 4, 1899.

The combination includes the armature of a circuit-closer, a pair of magoetically separated magnetic conductors above the armature, aad a pair of contact rails, each forming a longitudinal magoetic continuation of one of the magnetic conductors.

627,486. Globe-holding Device for Electric Arc Lamps. Thomas E. Drohan, Chicago, Ill. Application filed May 21, 1898.

A slotted cup or receptacle is provided wherein the globe is adapted to be placed; a ring is mounted upon the exterior of and rotatable with respect to the cup, aad clamping fingers are provided upon the ring and extending through the slots, the walls thereof heing adapted to cause the fingers to engage or release the globe as the ring is rotated in one direction or the other.

627,487. Globe. Thomas E. Drohan, Chicago, Ill. Application filed December 23, 1898.

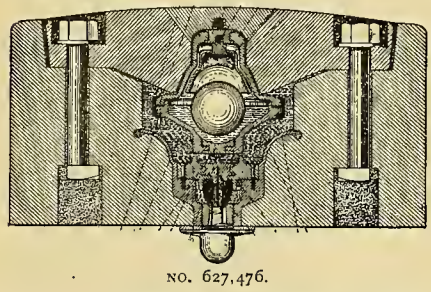
The globe has an opening in the bottom; a cap normally covers the opening upon the inside of the globe, the cap being of larger diameter than the diameter of the opening, and a projecting lug upon the upper surface of the cap.

627,488. Frame or Yoke for Dynamo-electric Machines. Charles A. Eck, Newark, N. J. Application filed February 25, 1899.

In a yoke or frame of the character set forth there is the combination with the wall of the yoke of a hole of substantially the same size as the field coils in the yoke.

627,494. Storage Battery. Warren P. Freeman, New York, N. Y. Application filed June 8, 1898.

A storage-battery plate is provided with a vertical channel on one side and a solid rib on the other side, with a series of V-shaped grooves or recesses extending transversely to the channel and rib.



NO. 627,476.

627,495. Overhead-trolley System. Emmerich Frischmuth, Berlin, Germany. Application filed February 17, 1899.

The means described for continuously supplying current to a moving car or vehicle consists of a trolley conductor connected with a source of electrical energy, of a supporting arch disposed at an intersection or switch, beneath which arch the trolley conductor is discontinuous and at which the ends of the conductors are laterally extended, a diagonally disposed contact part carried upon the moving car or vehicle, the same being adapted continuously to engage the conductor and to supply current to the propelling motor provided upon the car.

627,502. Motor-connecting Box for Electric-railway Vehicles. Strathearn Hendrie, Detroit, Mich. Application filed December 24, 1898.

The controller is carried hy the car body and the motor hy the car truck, a connecting box completing the circuits between the controller and motor, comprising a member secured to the vehicle and a second member detachably secured to the first-mentioned member.

627,519. Electrical Connecting Cord. Charles H. McEvoy, Lowell, Mass. Application filed January 23, 1899.

A flexible electric conductor, comprising a conducting core, a conducting tip in electrical connection with the core, a non-conducting comparatively inextensible covering for the conductor, reaching nearly from end to end of the core, and a link secured to the covering and the tip.

627,530. Electrical Speed Indicator. August Raps, Berlin, Germany. Application filed August 19, 1898.

A speed and direction indicator consists of a dynamo-electric machine connected to be driven by the indicated shaft or part, a separate source of electrical energy connected with the field circuit of the dynamo-electric machine, an electrically operated speed-indicating device connected with the armature circuit of the dynamo-electric machine. an electrically operated direction-indicating device connected with the field circuit of the dynamo-electric machioe, and automatic means for reversing the field circuit when the direction of rotation of the indicated shaft or part is reversed.

627,531. Dynamo-electric Machine. Wilhelm H. A. Rotth, Berlin, Germany. Application filed March 11, 1899.

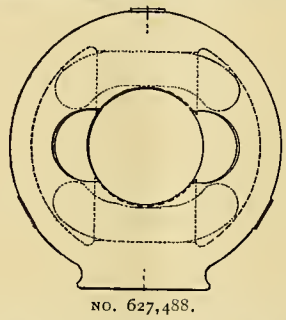
Shields or casings are disposed at the sides and cooform approximately to the adjacent field magnets and armature between which ventilating passages are provided, the casings having openings provided near the axis of the armature communicating with ventilating passages provided therein, whereby cool air is supplied to the ventilating passages and circulated throughout the machine.

627,549. Electric Controller. Gustaf Valley, Johnstown, Pa. Application filed January 7, 1897.

In an electric controller a rotatahle drum has a plurality of contacts, an auxiliary drum is rotatable with the first-mentioned drum and in electric circuit therewith, the auxiliary drum being surrounded by an arc-extinguishing medium and having a plurality of contacts placed in such relation with the contacts of the first-mentioned drum that the circuit is always made and broken by the auxiliary drum.

627,565. Electric Traction Motor. Friedrich W. E. Zander, Charlottenburg, Germany. Application filed February 17, 1899.

Claim is made for the combination with laterally acting traction rollers, of an electric motor connected with and adapted to rotate the same, an electromagoet associated with one of the rollers, and a coacting armature associated with the other of the rollers, the electromagnet having a winding connected in series with the motor, whereby the pressure of the traction rollers is varied in accordance with the operative conditions of the motor.



NO. 627,488.

627,573. Electrode. Charles C. Connor, Belfast, Ireland. Application filed December 28, 1897.

An electrode comprises a number of pieces of carbon, each having a perforation therein, arranged one above another with a distance ring between each piece, and connected together by a longitudinal core of cast-lead or other like metal or alloy.

627,577. Telephone. Cleaveland F. Dunderdale, Chicago, Ill. Application filed December 16, 1895.

In a telephone a primary imperforate diaphragm, a secondary centrally perforated diaphragm held in parallelism with but spaced from the primary diaphragm, and a permanent magnet with helices thereon, the ends of which are in proximity to the primary diaphragm but opposite to the perforation of the secondary diaphragm, the ends of the magnet being of opposite polarity.

627,641. Battery. Valentin Halski, Lemburg, Austria-Hungary. Application filed October 31, 1896.

The combination includes two battery cells for feed tubes, leading to near the bottom thereof, and a swinging distributer above the tubes arranged to tilt and feed the liquid first into one tube and then into the next.

627,686. Automatic Electric Switch. John L. Creveling, New York, N. Y. Application filed January 18, 1899.

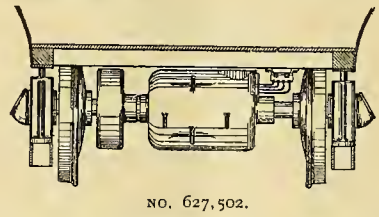
A main circuit containing a dynamo, a storage battery and an electromagnetic make-and-break switch having a coil or coils in the main circuit and having opposing coils in a derived circuit across the battery and an actuating coil or coils in a derived circuit across the dynamo mains.

627,736. Electric Coin-freed Apparatus. Johann H. F. Krull, Hamburg, Germany. Application filed January 17, 1899.

The essential features are a carrier for the object to be delivered, a pair of electromagnets having coils wound in opposite directions, an oscillating armature having its coil wound in one direction, the armature operating the carrier, a main electric circuit including the armature coil and one of the coils of each of the electromagnets, circuit-closing devices, comprising a fixed and a movable contact interposed in the circuit, a branch from the main circuit including the second coil of each electromagnet, and circuit-closing devices comprising likewise a movable and a fixed contact interposed in the branch circuit; of a coin guide for guiding a coin first to the main-circuit contacts, then to the branch-circuit contacts to successively close the circuits through the coin, and means operated by the aforesaid armature for obstructing the coin guideway in advance of the main-circuit contacts.

627,759. Joint for Electric Conductors. Harry W. Neild, London, England. Application filed November 14, 1898.

A sleeve open at one side for part of its length and coated internally with solder.



NO. 627,502.

627,772. Electro-hydraulic Brake for Railway Vehicles. Camille Durey, Paris, France. Application filed January 5, 1899.

In an electro-hydraulic brake of the kind described there is an electric distribution comprising two electromagnets for operating respectively the valves for closing the accumulator and opening the front chamber of the brake cylinder, the electromagnets being actuated by two distinct sources of electricity and connected with a single operating switch, enabling the putting on or releasing of the brake, and the extent of braking to be regulated simply by varying the duration of passage of the current in the electromagnets by means of a single handle.

627,784. Conduit for Electrical Conductors. Charles H. Sewall, Chicago, Ill. Application filed April 24, 1899.

The combination with the foundation material of a street pavement of a conduit formed therein and a roadway or paving supported thereon.

627,799. Telegraphic Sounder. Jesse H. Bunnell, New York, N .Y. Applicaton filed August 31, 1898.

The sounder has a compound base made of three or more interconnected plates, one of the plates being of wood and rigidly held between the others, and in such manner that the edges of all of them shall be free to vibrate, the lower plate of the set being of metal and constituting a means for protecting the others.

627,813. Telephone-circuit and Switching Apparatus. Thomas C. Wales, Jr., Newton; Mass. Application filed March 14, 1899.

The switching system comprises a series of relay substation circuits, a series of linking-cord circuits, a centralized common source of energy in two serially connected portions and a common return wire or conductor connected by one end between the portions; the substation circuits being in two divisions, each circuit consisting of a single conducting wire connected at the substations to the common conductor, and provided with open terminal sockets at the switchboard sections, and extending through the relay-switch, one division thereof being connected to one portion of the source of energy and the second division connected to the second portion thereof.

627,814. Telephone-exchange Switch Apparatus and Circuits. Chester H. Arnold, Boston, Mass. Application filed March 31, 1899.

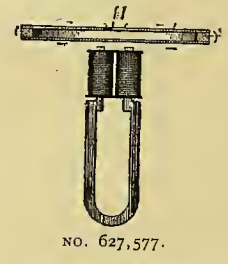
A repeating induction coil comprising two conductive circuits, both constituted of four substantially equal serially connected windings, each having an intimate inductive relation with a different winding of the other circuit, the first and last windings of the series of each circuit being thus paired with the first and last respectively of the other, and the second and third serial windings of each circuit with the third and second respectively of the other.

627,837. Electric Circuit Closing Device. Ferdinand Wilke, Akron, Ohio. Application filed April 8, 1899.

The casing and the contact members therein in a normally open circuit, a plunger supported in the casing with one end arranged to press one of the contact members out of contact, a fusible member engaging the opposite end of the plunger and exposed to the outer air, and means to hold the fusible member in operative position against the end of the plunger to keep it depressed.

627,866. Telephone Writing-desk. Daniel H. Moore, St. Louis, Mo. Application filed February 4, 1899.

The board is attached to the bars and posts are attached to the rear ends of the board. Friction rollers are mounted between the posts one above the other and in frictional contact with each other, the straight-edge connecting the posts just behind the rollers, a crank operating the rollers, the clamp-jaws extending from the bars, the hangers extending downwardly from the rear one of the bars, the hooks upon the lower ends of the hangers and a spindle operating in the hooks.



NO. 627,577.

627,908. Electrical Measuring Instrument. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa. Application filed April 1, 1899.

Claim is made for the movable member of the indicating mechanism, an actuating coil and a combined supporting and damping device, of a spiral spring interposed between the device and a stationary part of the instrument, the weight of the spring being supported by the stationary part.

627,917. Dry Cell. Manes E. Fuld, Baltimore, Md. Application filed January 21, 1899.

In a dry cell there is the combination with a zinc shell forming the cell-case and also one of the electrodes, of a hottom seal composed of pitch and resin, a carbon electrode resting on this hottom seal and provided with a transverse slot near its upper end, a granular mass composed of powdered graphite and one or more depolarizing agents surrounding the carbon electrode, plaster-of-paris impregnated with one or more active agents surrounding the granular mass and interposed between the mass and the zinc shell, and a top seal hermetically sealing the upper end of the cell and projecting into and through the transverse slot in the carbon electrode.

627,927. Continuous-contact Trolley. Chester B. Lebcher, Plains, Mont. Application filed August 22, 1898.

A trolley having a main wheel and a supplemental hisected wheel, the latter resting normally above the wire or conductor and adapted to be brought on the under side of the wire or conductor when an obstruction is met, hy the hisected wheel provided on the outer sides of its two members with star-wheels, the points of which project beyond the peripheries of the two members of the hisected wheel.

627,937. Dynamo-electric Machine. Louis O. Lieber, Los Angeles, Cal. Application filed February 2, 1899.

In this machine the number of commutator-bars is indivisible hy the number of poles, the combination with the commutater, of brushes, the contact-face of each of which is of a width less than that of all of the commutator-bars of one polarity which connect with one series or group in the winding, and greater than that of all of the bars less one; the brushes being arranged in their relation to the bars in overlapping groups; that is to say, the last brush of one group heing the first brush of the succeeding group; the groups of bushes being equal in number to the difference between the whole number of commutator-bars and the next higher multiple of the number of poles, the space hetween the centers of the outside poles of each of the several groups being uniform and each equal to the space occupied by an even number of bars, and the space from center to center of any two poles being a multiple of the space hetween the centers of two successive hars.

627,955. Portable Electric Lamp. Albert Doss and William F. Doss, Denver, Colo. Application filed August 1, 1898.

A portable lamp is described comprising a support, a lamp proper and two arms revolubly connected with the lamp at one extremity and with the support at the opposite extremity.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, JULY 15, 1899. No. 3

Additional Niagara Equipment.

In order to increase its incandescent-light facilities, the Buffalo and Niagara Falls Electric Light and Power company has had built by the Walker company of Cleveland a new dynamo, which has been installed in the station of the Niagara Falls Hydraulic Power and Manufacturing company at the water's edge in the gorge. This dynamo will be direct-connected to one side of the turbine that now operates the generator from which the National Electrolytic company receives its current, as shown in Fig. 1. This turbine is of 2,500 horse power capacity. The new dynamo is of the alternating-current type of 700 kilowatts capacity at a voltage of 2,200. It will be operated at 250 revolutions per minute and 125 cycles a second. There will also be installed a continuous-current exciter of sufficient capacity to supply current to the fields of the dynamo to permit of its being operated so as to produce 1,100 kilowatts for a short time. Details of construction are illustrated in Fig. 2, page 32.

This new dynamo wil carry 12,000 lights at full load, but it is understood to be the intention of the company to divide this load between the station at Fourteenth street, opposite the station of the Niagara Falls Power company, and the new machine, and possibly also with a plant it now has in the basement of the Cliff paper mill. The original intention was, however, that the new machine would enable the company to do away with the last-mentioned service. Increased business may change this plan. The switchboard will be of blue Vermont marble.

Frank G. Lott is the manager of the company, and it is under his supervision that the new dynamo has been installed.

Freight Traffic on an Electric Railway.

The freight traffic of the Detroit, Ypsilanti and Ann Arbor electric railway promises to be a profitable branch of the business of that line. Every day two shipments are made from its office-depot on Griswold street, in Detroit, says the Tribune of that city, and two shipments are received back at the same place. The receipts from inbound freight average $10, and for outbound freight about $25 a day; and it is expected that the total receipts will be increased to more than $100 a day by June, 1900. Ann Arbor takes about half of the freight and Ypsilanti is next in volume, but shipments to Wayne are daily increasing. A good deal of the freight consists of vegetables and groceries, although trunks and all light articles usually carried in express cars on steam railroads are also taken.

Submarine Boat Argonaut.

The new Argonaut, a 60-foot submarine boat, designed by Simon Lake of Baltimore and owned by the Submarine Boat company, was put into the water at Brooklyn last week. The boat is fitted with three rollers, one on the starboard side, another on the port side and another beneath her screw. It is expected that, with the aid of the rollers, the vessel will be able to move on the ocean's bottom. The boat weighs 70 tons without her machinery, has motors of 60 horse power, a suction-hose pump connecting with a floating tank to supply her with air while beneath the water, sleeping berths for eight persons, electric lights, a pumping apparatus for removing 800 gallons of bilge a minute and a 4,000 candle power searchlight. She is driven by electricity, storage batteries supplying power. There are five compartments. In the bow is a door to allow the diver to leave the boat while she is submerged. By the use of hydraulic air pressure this door can be left open while the divers are going from one compartment to another, as the air pressure prevents the water from rushing in. The boat in making a descent will not dive, but will go down with her keel parallel with the surface of the water. The compressed-air tanks when filled will contain a supply of air sufficient to last 48 hours. As soon as the necessary fittings are put in the new Argonaut will go to work recovering treasure and valuables from several wrecks along the coast. She will carry a crew of eight experienced wreckers.

Chicago Ordinance Regulating the Operation of Automobiles.

At the last meeting of the City Council an ordinance was adopted to regulate the operation of automobiles on the streets of Chicago. This ordinance, which is based to a large extent upon the suggestions of Mr. E. B. Ellicott, the city electrician, consists of 11 sections.

An automobile is defined to mean any vehicle propelled by electricity, compressed air, naphtha, gasoline, kerosene, "or any motive power other than animal power or motive power supplied solely by the muscular exertion of a human being." It is provided, however, that the ordinance shall not apply to the cars of steam or street-railway companies.

A Board of Examiners of Operators of Automobiles, to consist of the city electrician, the commissioner of health and the city engineer, is established to examine and license persons who desire to operate self-propelled vehicles. No one shall be allowed to operate such a vehicle without a license. Examinations are to be held monthly to determine the mental and physical qualifications of applicants, who must possess a sufficent amount of technical knowledge and ability to understand the working parts of the mechanism of their vehicles. Successfully passing the examination, the applicant is furnished a license authorizing him to act as an automobile operator. This certificate is good for one year, on payment of a fee of $3. On renewal the yearly license fee is $1. Operators' licenses may be revoked by any member of the Board of Examiners at any time for sufficient cause. The mayor is to appoint a secretary to the Board of Examiners and full records of all applicants must be kept.

No automobile shall be propelled on the streets of Chicago at a greater speed than eight miles an hour. Each self-propelled vehicle must be provided with an alarm bell or gong, not less than four inches in diameter, to be sounded at crossings and at other places where its use is deemed necessary by the operator. Brakes of sufficient power

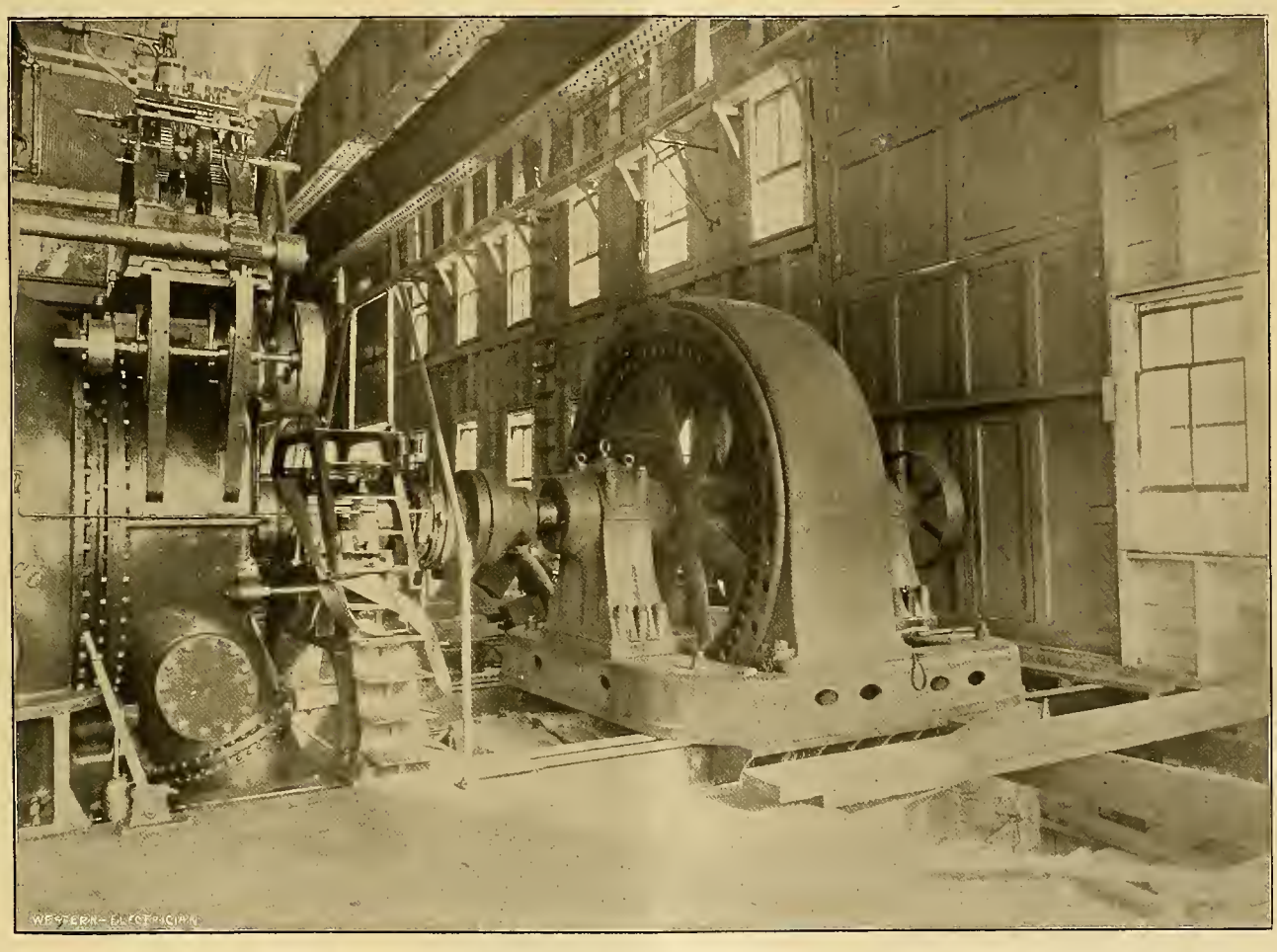


FIG. 1. ADDITIONAL NIAGARA EQUIPMENT.

to stop the vehicle within 10 feet when going at eight-mile speed must be provided. Automobiles in motion on the streets must carry lighted lamps after dark.

For violation of any provision of the ordinance the penalty is a fine of not less than $5 nor more than $25 for each offense.

It is believed that the mayor will sign the ordinance, which will then become a law as soon as due publication is had.

Electrical Imports in Japan.

The utilization of electricity is making rapid progress in Japan, and it is satisfactory to note that the United States is getting a considerable share of the requirements for new works. As showing the value of the Japanese demand in this direction, and as a matter of comparison, the figures of the importations from Germany, England and the United States will be of interest.

The importations of dynamos and other electrical machinery from Germany increased from a value of $41,180 in 1895 to $150,000 in 1896 and to $167,000 in 1897. England furnished $174,000 worth of goods in 1895, $230,000 worth in 1896 and $185,000 worth in 1897. The importations from this country took an enormous increase within a year or so, jumping from a value of $67,200 in 1895 to $680,000 in 1897.

The Verkehrszeitung of Leipsic, in a recent issue, lays stress on these figures and, for the benefit of its clients, adds that "the reason for this enormous increase in American exports to Japan is: Short terms of delivery, strict observance of the terms of sale, low prices and excellent construction."

A year ago Japan had 39 companies operating lighting plants. Four of these used water power, two water and steam power, and the others steam power only. Besides these plants, the Japanese government has stations in Tokio, Saseto and Kura. Tokio is supplied with electric light partly by the Tokio Electric Light company and partly by Siemens & Halske's private plant. The Japanese firm of Kyoto-Suizi-Yimusko, which gets its power from the Lake Riera Canal, and supplies the Kyoto street railway and a number of other industrial works, the copper mines in Ashio and the silver mines in Inai, use German material, and a copper mine in Beshi, which is to adopt electrical power, is about to order the machinery from South Germany. So that, despite the big inroads already made by Americans on the trade, they will require to keep watchful eyes on new developments.

There are very few electric railways in Japan. The four street railways in Kyoto City, Hagoija, Kawasaki-Daischi and Odawara-Yumoto use American motors of the Walker and General Electric types.

International Electric Railway.

It is expected that before the month of July is passed the International Traction company will have made connection between its Canadian and New York state lines on the upper steel-arch bridge at Niagara Falls. The commissioners of the New York State Reservation are expected to pass upon the plans for a track or tracks on the riverway which will make the connection possible. The point where the lines will meet and be joined on the great arch is well portrayed in the illustration, the photograph representing the scene presented to one looking across the deck of the bridge.

INTERNATIONAL ELECTRIC RAILWAY.—BRIDGE WHERE NEW YORK AND CANADIAN LINES WILL CONNECT.

City Electrician Needed in Rochester.

A Rochester (N. Y.) fireman named Frank J. Klueh met death while in the discharge of his duty on Sunday, July 2d, by coming in contact with a burning converter on the outside of a building, which gave him a fatal shock. It was supposed that there was a fire in the building, but Chief Boon discovered that this was not the case and warned Klueh not to touch anything. To all appearances

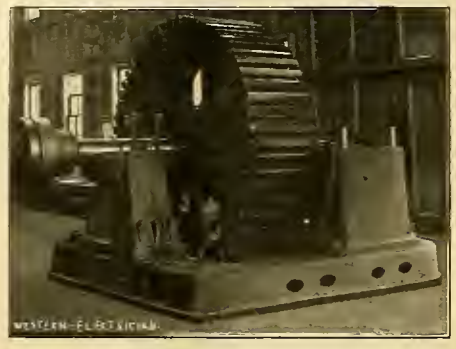


FIG. 2. ADDITIONAL NIAGARA EQUIPMENT.

he received this warning, but just as he had taken one step down the fire-escape, he was seen to throw up his hands, and his fellow-firemen realized he had received a shock. All efforts to revive him failed. At the time he had on leather shoes, but no gloves. The other firemen wore gloves and rubber boots. Rochester has no city electrician, and the coroner's jury, in this case, rendered a verdict recommending that the city engage a man for the position of city electrician, his duty to be to see that all dead wires are removed and that all wires are properly strung, and to give firemen and policemen instructions in regard to electric wires and converters to add to their safety in the performance of their duties.

Effects of Lightning.

The United States Weather Bureau has just issued a statement of damage to property and loss of life by lightning in the United States during the last nine years, from which it appears that 312 persons are killed annually by lightning stroke in this country, taking a fair average. In this respect the worst year was 1895, when 426 Americans were destroyed in this way; in 1898 the mortality was 367. In nine years, from 1890 to 1898, inclusive, five individuals in every million of the population of the United States were killed by lightning. The danger from this cause seems to be least in large cities and in thickly populated districts. Agricultural laborers furnish the most victims. Ohio is the greatest sufferer, the death rate by lightning in that state being 24 in every 100,000 persons of the farming class. The greatest proportion of fatal strokes is found in the Missouri Valley, on the Great Plains and in the Rocky Mountain region.

In 1898 no fewer than 1,866 buildings were damaged or destroyed by lightning in this country, involving a loss of $1,446,880. During the same year lightning killed 964 cattle, 306 horses, 30 mules, 116 pigs and 426 sheep, representing a total value of $48,257. All of this destruction of farm animals was accomplished by only 710 "strokes." Much of this damage might be avoided by grounding wires at suitable intervals along lines of barb-wire fences, which are sometimes deathtraps to stock, the fatal shocks being inflicted often through the medium of the wires at a considerable distance from the point hit. So far as human beings are concerned, practically all of the deaths occur during the five months from April to September, the highest record being in June and July.

Sarcasm in Vincennes.

The familiar question of electric street lighting—whether by the municipality or the existing company, and, if by the latter, for how much—is up in Vincennes, Ind., and has elicited a communication signed "Taxpayer" and published by the Daily Sun of Vincennes, in which the municipal-ownership claims are treated in a sarcastic vein. Following is an extract:

"The [City] Council has been offered, since the bids were opened, as I notice from the Capital, arc lights, 2,000 candle power, all night and every night, for $40 a year, with the prospect of getting them much lower, perhaps down to $20 or $25. And why not? A few poles and wires, and a boiler and engine, a dynamite or two is all that is needed. Electric lights are made out of nothing but air anyhow, and all that is needed is the dynamites to set the air afire, and the wires to carry the light when needed. The air used belongs to all, rich and poor alike, and costs nobody nothing, and the dynamites and wires don't cost such a great fortune as the home company try to make people believe.

"Like Colonel Taylor, for one I am in favor of throwing open the doors and tearing down the fences and scattering the rails, and let the whole world come in and help us to bust the rings and make this the best lit city in the world, by giving outsiders a chance with our gas barons and electric magnates, that have lorded and rode roughshod over us so long, with cork heels and steel toes. They put a few hundreds or thousands of dollars into their old scrap piles 25 years ago, and ever since they have set down and feasted and wined and dined on the fat of the land, and there they set yet, holding up their plates for more. Not one of them have ever to strike a tap, or do a lick of work, but living all this time off the taxpayers."

Recent Marconi Experiments.

Acting in conjunction with Mr. Marconi, the French naval authorities conducted some successful experiments with wireless telegraphy between ship and shore in the English Channel last month. The French cruiser Vienne was used for the purpose. One of Marconi's installations was fitted up on board and the inventor was present on the cruiser to superintend the experiments. Wimereux, near Boulogne, and the South Foreland lighthouse, on the English coast, were used as the land stations. One important feature about the operations is the distance covered. Hitherto, the distance between the South Foreland and Boulogne, about 28 miles, was the greatest through which these ethereal messages have been transmitted; but in the recent trials it was decided to increase the distance. Messages were transmitted between the cruiser and the English land at intervals until the vessel reached a point 12 or 14 miles south of Boulogne. The greatest distance through which the messages were transmitted was 42 miles. The increased distance appeared to have not the slightest effect upon the current, the messages being recorded at the receiving station at the South Foreland with unvarying distinctness. The experiments commenced at 8 a. m. and were continued throughout the day. In the afternoon the channel was enveloped in an exceedingly dense fog, but it did not in any way affect the transmission of the messages. On the cruiser the current was caught by means of a wire passing up the masthead, and messages were exchanged while the vessel was traveling at various conditions of speed.

Phosphorescence of Incandescent Lamps.

L'Electricien mentions the fact that in testing the rarity of the atmosphere in the lamp globe by striking it smartly on the sleeve or palm of the hand, or, better, hitting the glass with a catskin, a phosphorescent light is seen, more intense as the exhaustion is more perfect. The philosopher Picard, over a couple of centuries ago, noted the same phenomenon in the exhausted portion of a barometer. Hawksbee produced similar results by shaking the mercury in a barometer, the light assuming a purple hue. M. Gerard found that this effect could be produced with a catskin and a Geissler tube.

It is claimed that after a certain exhaustion is reached the phosphorescence becomes feebler, and as the vacuum is advanced to perfection the illumination becomes almost invisible.

With practice, it is claimed that a very fair test of the vacuum can be made in the way indicated.

An electric railway is shortly to be built between Frederick and Libertytown, Md. It will be 11½ miles long and probably will be extended to Union Bridge.

Air-gap and Core Distribution.[1]

By W. Elwell Goldsborough.

The exact analysis of problems, the solution of which depends upon a knowledge of the actual distribution of the magnetic flux in masses of iron, seems to have received scant attention if we judge the present development of the design methods in use by the writings of Essen, Kapp, S. P. Thompson, Hopkinson, Elihu Thomson, Ryan and many more of our engineers who have instructed us so well in other and intricate matters pertaining to the efficient construction of electrical machinery.

The only reference to researches bearing directly upon this subject known to the writer was made by W. M. Mordey during his discussion of Dr. John Hopkinson's paper on the "Propagation of Magnetism in Iron," before the Institution of Electrical Engineers. He stated that some seven or eight years ago he made a test with the object of finding whether the penetration in laminated iron took place evenly over the whole area of the sheet. Although the length of certain paths of the magnetic parts was necessarily greater than others, he found the magnetic density uniform. He accounted for it by assuming that any tendency to a greater density in one place would be counteracted by the relatively stronger permeability elsewhere.

I am not informed as to the character of the apparatus which Mr. Mordey used in obtaining his results, nor am I sure that he performed his experiments with the end in view of investigating the subject from the standpoint from which it is taken up in this paper. Certain it is, however, that all theoretical considerations point to the fact that, as used in electrical apparatus, laminated iron is not in general so placed as to warrant the assumption that there is an even and uniform distribution of the flux in planes at right angles to the direction of the flux paths.

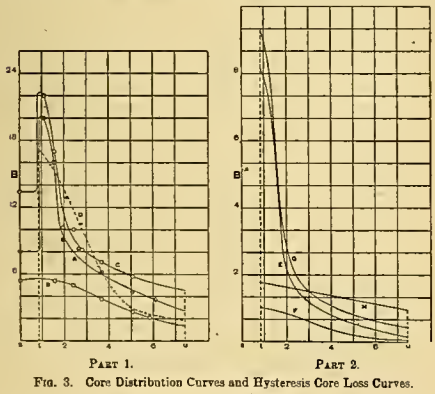


Fig. 3. Core Distribution Curves and Hysteresis Core Loss Curves.

AIR-GAP AND CORE DISTRIBUTION.

In many instances where the iron is not subject to cyclic fluctuations in the intensity of the magnetic lines, variations in the density in planes at right angles to the mean path of the flux are unimportant; but is this true in the cases where masses of iron and steel are made to revolve in strong magnetic fields? or when fields of flux are induced in masses of iron and by coils excited from sources of alternating electromotive force?

In discussing this matter, suppose we consider the condition existing in the armature core of a six-pole, 110-kilowatt railway generator, a half-section through the armature and field ring of which is shown in Fig. 2. We have shown in section A of Fig. 1, by the dotted curve extending across the pole-face, the air-gap distribution of the flux at no load. It is practically uniform over the pole-face, owing to the toothed-armature construction and the relatively narrow clearance space. Inasmuch as only a little over one per cent. of the total field-ampere turns is used in forcing the flux through the armature core and 73 per cent. is needed to force the flux through the double air-gap, the assumption that the surface of the armature under any pole-face is an equipotential area is admissible. The problem of determining the exact position of the flux paths and the density

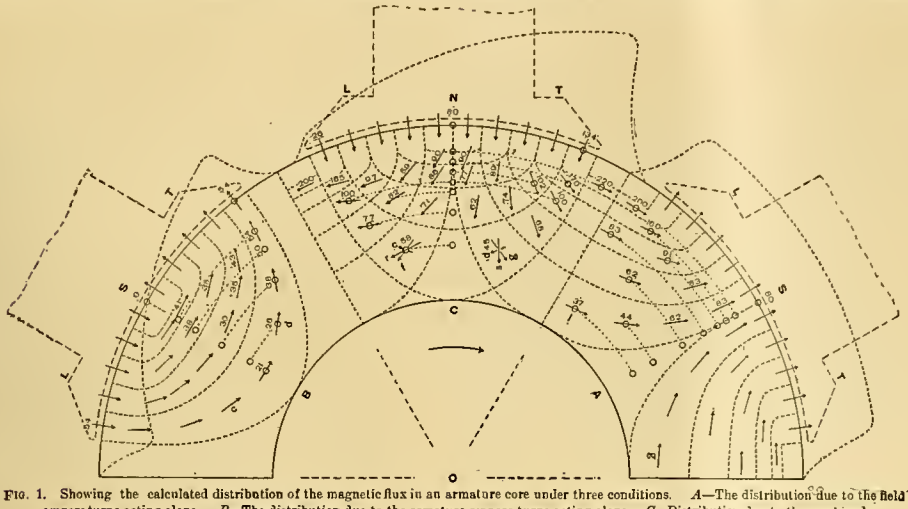


Fig. 1. Showing the calculated distribution of the magnetic flux in an armature core under three conditions. *A*—The distribution due to the field ampere turns acting alone. *B*—The distribution due to the armature ampere turns acting alone. *C*—Distribution due to the combined action of the field and armature ampere turns. The numerals give the values of the flux density in decigausses.

AIR-GAP AND CORE DISTRIBUTION.

at various points in the plane of the section then resolves itself into a problem of dividing that portion of a lamina that lies between the center lines of two adjacent poles into paths of equal magnetic reluctance connecting equipotential surfaces.

The pole-face over section A of Fig. 1 has been divided, parallel to the shaft, into 10 equal

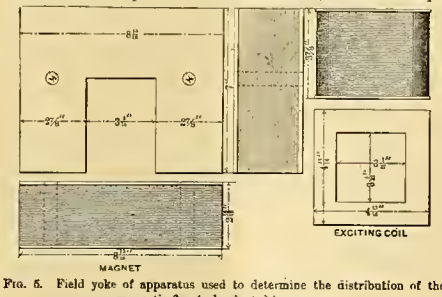


Fig. 5. Field yoke of apparatus used to determine the distribution of the magnetic flux in laminated iron cores.

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strips, and these have been projected upon the armature surface as shown. The dotted lines joining the pole-faces through the armature show the dividing lines between the paths of equal reluctance. These paths have been determined by first equalizing their reluctance on the basis of a permeability of the iron of unity and then making

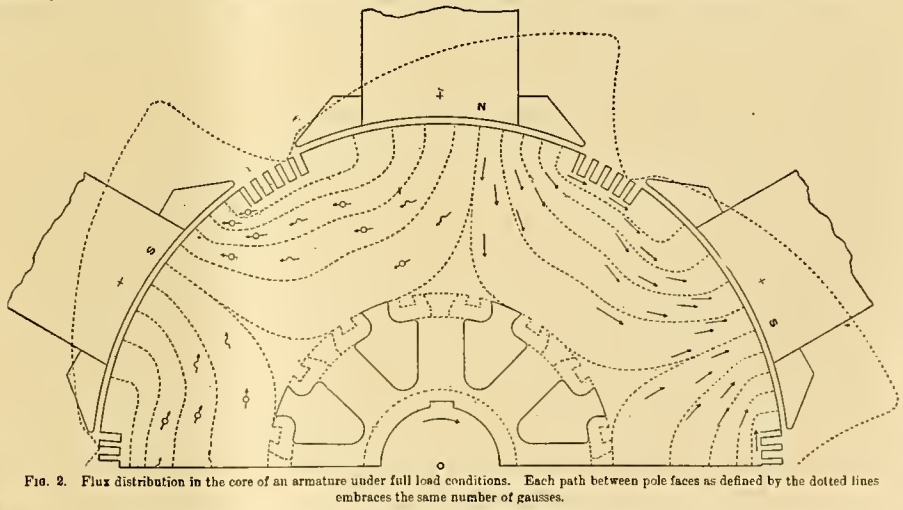

Fig. 2. Flux distribution in the core of an armature under full load conditions. Each path between pole faces as defined by the dotted lines embraces the same number of gauses.

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the necessary connection for the variations in the permeability of the iron with the varying densities by successive trial. Since each of the paths has the same reluctance and is influenced by the same magnetomotive force, acting at their terminal points, the same number of webers passes through each path and the number of gausses at any point on the center line of a path is equal to the flux per path in webers divided by the width of the path in centimeters at the point considered. The arrows drawn in section A show the direction taken by the flux at as many points and the numbers indicate the densities at the center of the arrows in decigausses. The magnetic density in the iron near the inner surface of the core on the dotted line between sections A and C is a little less than 3,000 gausses, while the density in the iron just below the teeth on the same line is a little over 21,000 gausses. At no load the flux paths are symmetrical about the section lines, except in so far as they are distorted by being slightly depressed under the leading pole-tips (L) and raised under the trailing pole-tips (T) as each molecule of iron is carried through the cycle of the hysteresis loops by the rotation of the armature. The arrows passing through the small circles indicate the points of maximum density in the rings having radii equal to the distance of these arrows from the center (O). In other words, a molecule of iron is subjected to the greatest magnetic stress when it passes under one of these arrows. The arrows are supposed to maintain fixed positions relatively to the poles, while the armature core rotates. Projecting the maximum density points of section A circumferentially on a radial line, and transferring them to Fig. 3, we obtain the curve (A), Fig. 3, Part 1. This curve shows the maximum core densities occurring in the iron at points having different radial distances from the center of rotation. The ordinates are expressed in kilogausses and the abscissæ in inches. The distance (s-t) is the depth of the slots; the distance (t-u) the depth of the core iron below the slots. The magnetic density of 8,000 plotted over (s-t) is the average density in the teeth and slots; the actual maximum density in the teeth at no load being 20,600 gausses. In laying out the equal flux paths of Fig. 1, allowance was made for the difference in the actual magnetic density in the iron of the teeth and the average magnetic density in the teeth and slots, by reducing the depth of the slots and increasing the length of the clearance space by an amount equal to the length of an air path having a width equal to the polar arc and a reluctance equal to the reluctance of the path through the teeth and slots.

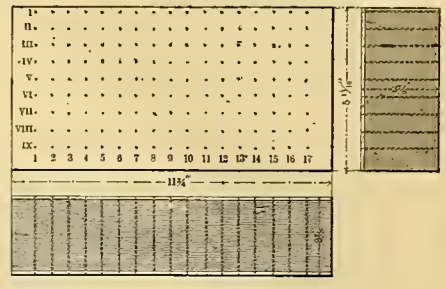

Fig. 4. Armature of apparatus used to determine the distribution of the magnetic flux in laminated iron cores.

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To determine the hysteretic loss occurring in the part of the core below the slots from the distribution curve (A) of Fig. 3, the ordinates of the curve (A) were raised to the 1.6 power of the density which they represent and then reduced in the ratio of their distance from the center of rotation to the distance of the point (t) from the center of rotation. In this way the curve (E), Fig. 3, Part 2, was obtained, the area of which is proportional to the hysteretic loss in the core. The correction for the difference in the distance from the center (o) of the successive points of the curve (A) is necessary, as the volumes of the rings which the densities influence vary 54 per cent. between the outside and inside rings. We, therefore, find that with the distribution given in section A of Fig. 1, the core loss due to hysteresis will be 663 watts.

If we follow the usual practice in making these

1 Read at the general meeting of the American Institute of Electrical Engineers, Boston, June 28, 1899.

calculations[1] and assume that the flux in passing between the poles spreads evenly over the core, the density in the core will be 7,220 gausses and the core loss 492 watts, than which the value given above is 35 per cent. greater. (See curve H.) Apparently, therefore, if we admit the basis upon which these calculations have been made to be correct the methods at present in use give erroneous results.

The discrepancy between the two methods, however, is greater than the consideration so far presented would lead us to suppose. In general it is assumed that if the total effective field ampere-turns impressed on the magnetic circuit are kept

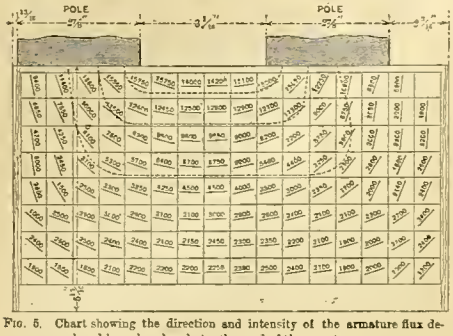

FIG. 5. Chart showing the direction and intensity of the armature flux developed by poles placed at either end of the armature core. Length of single airgap, about .015" Field ampere-turns, 1405.

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at a constant value, i. e., if the difference between the armature back-ampere-turns and the total impressed-field ampere-turns is kept at a constant value, the armature losses in the part of the core that is below the slots will remain constant in value from no load to full load.

With a view to investigating this point, suppose we consider the effects produced by the cross-magnetizing armature ampere-turns when the field circuit is open and the armature coils are separately excited. Under these conditions, as shown in section B of Fig. 1, a field will be set up through the trailing pole-tip (T), across the air gap; through the armature core and back across the air gap, up into the leading pole-tip (L). The ampere-turns acting to set up this field will be zero about the center line of the pole-face, but gradually increase to a maximum under the pole-tips. The magnetomotive force acting on the core paths between the two halves of the pole-face will be proportional to the ampere-turns, and if paths be traced through the armature core, connecting points on either side of the center line of the pole-face and having a constant reluctance, the average flux density per path will be proportional to the magnetomotive force impressed upon each path and a balanced system of forces will be established in the armature core. The paths traced in section C have been calculated, with due reference to the permeability of the iron at different densities, to fulfill this condition; and the densities as indicated by the numbers over the arrows have been determined as being the actual densities set up in the core by the cross-magnetizing ampere-turns. Owing to the fact that the magnetomotive force acting on the longest path has the greatest value, the arrow points of maximum circumferential density all fall in this path. When these points are projected on the center line and the values they represent transferred to Fig. 3, we get the curve (B), which gives

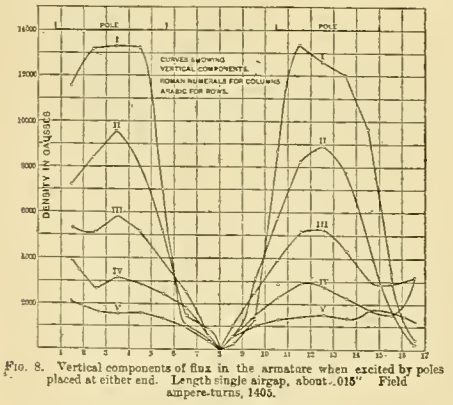

FIG. 8. Vertical components of flux in the armature when excited by poles placed at either end. Length single airgap, about .015" Field ampere-turns, 1405.

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the values of the maximum densities through which the iron passes as it is revolved under the poles. In calculating the hysteretic losses that will take place in the core with separate armature excitation, we get curve (F), obtained from curve (B) in the same way that curve (E) was obtained from curve (A), and find that the core losses will amount to 174 watts.

Now to determine the distribution in the core at full load, when the total effective field ampere-turns are kept at the no-load value, we must combine the results already obtained and recorded in sections A and B of Fig. 1. This was done and each of the arrows of sections A and B were properly transferred to section C and the vector sums taken. As examples, vectors (f) and (c) were combined, as shown, to obtain vector (r), and vectors (g) and (d) were combined to obtain vector (s). Again, it must be noticed that vector (i) is numerically equal to vector (g), and vector (c) is numerically equal to vector (d), but, owing to the difference in the angular positions they assume when combined, vector (r) has a value 29 per cent. greater than the value of vector (s). It is is also interesting to notice that as the load comes on the machine, the density at the point (f) gradually increases, with constant effective field excitation, from 4,400 to 5,800 gausses at full load, and that an increase of 32 per cent. in the flux density at this point has produced an increase of 55 per cent. in the core losses per unit volume for all iron at a distance of (f-o) from (o).

These same considerations apply to all the points in the armature core to a greater or less degree and result in giving us an entirely new distribution of the flux in the core. The points of maximum radial or circumferential density are also changed, and we find them located under the trailing pole-tip (T) of section C, in the leading pole-tip (L), in the lower part of the core. If we project the maximum density points upon the center line and transfer them to Fig. 3, we now get the curve (C), the curve of maximum core densities at full load. Calculating the hysteretic losses, we get the curve (G), and finally determine the full-load loss to be 830 watts. Between no load and full load, therefore, while the total flux entering the armature per pole is maintained at the same constant value, the hysteretic loss in the core would seem to increase from 663 to 830 watts, or 25 per cent. And if the final value of 830 watts is compared with the uniform density value of 492 watts, we see the discrepancy in methods is really much greater than at first seemed probable, being 69 per cent. instead of 35 per cent.

Of course, these values refer only to the losses in the solid part of the core below the teeth. The hysteretic loss in the teeth at no load is 132 watts,

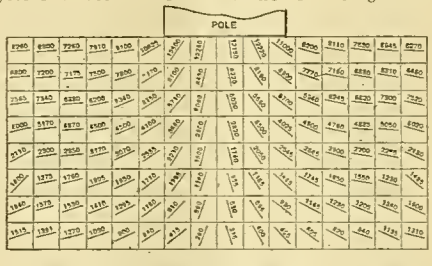

FIG. 9. Chart showing the direction and intensity of the armature flux, when one pole is acting at the center of the armature. Airgap, .0612". Field ampere-turns, 1875.

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and at full load 246 watts, owing to the change in the density under the strong or trailing-pole corner, and an additional 27 per cent. must be added for eddy-current losses. The total armature-core losses at no load are, therefore, 1,000 watts, and at full load 1,370, and the real increase in the total core losses from no load to full load is 37 instead of 25 per cent.

The increase in the core loss with the load which these calculations show probably accounts in part for the failure of many machines to come up to the expectations of their designers, and certainly presents an interesting field for speculation. With each change in the depth of the core, the core distribution of the flux changes. With each modification of the percentage of the armature covered by the poles it changes. With each modification of the armature winding, the distribution of the flux in the core changes. All these matters have a direct bearing upon the core losses and are interesting as problems.

In Fig. 2 the results obtained in connection with Fig. 1 are displayed. The equal flux paths traced between the poles have been carefully located with reference to the full-load flux distribution and without reference to the direction of the vectors. It will be seen, however, that the black vectors on the right, which are the same as those of section C, Fig. 1, follow quite closely the direction of the paths, as is to be expected. On the left of Fig. 2 the trace is shown of only the maximum-density vectors, to the end of bringing out more clearly the effect upon the core distribution of the armature ampere-turns. It will be seen that they have the effect of forcing the flux toward the bottom or inner periphery of the core under the leading pole-tips, and of crowding it upward toward the outer periphery of the core under the trailing pole-tips. Accordingly, the maximum density curve (C) of Fig. 3 has an area a number of per cent. greater than the area of a similar curve plotted from densities taken in a plane at right angles to the direction of the flux. In other words, the area of the curve (C) represents a greater amount of flux than really exists in the armature core.

The regulation of the machine here discussed is modified to some extent by the effect of the saturation that occurs in the teeth and cast-iron pole shoes, so that the full-load air-gap distribution is better than that shown in section C of Fig. 2, but for the sake of simplicity in taking up the subject for discussion, all modifying factors of this character have been eliminated.

With the end in view of obtaining experimental evidence of the correctness of the method of determining core losses that has been outlined above, two of my students, Messrs. W. T. Hensley and E. B. Kirk, constructed a special piece of apparatus. As shown in the illustration (Fig. 15), it is an electromagnet, resembling as much as possible one pair of poles of a multipolar dynamo with a section of the armature. The armature is of rectangular form. As the flux divides in the pole of a multipolar machine, each pole of the magnet was made to represent half a pole of a dynamo.

The magnet is built up of thin plates of trans-

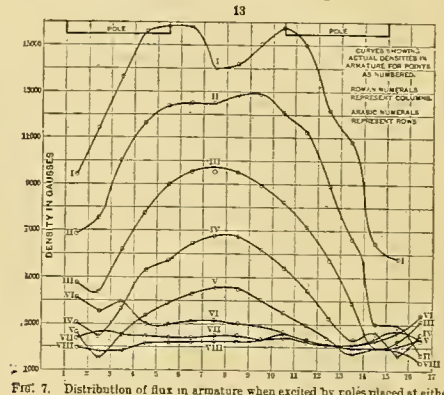

FIG. 7. Distribution of flux in armature when excited by poles placed at either end. Length of single airgap about .015' Field ampere-turns, 1405.

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former iron, .015 inch thick. Working drawings of the magnet and its parts are shown in Figs. 4 and 5.

The core and armature are made up of 180 of these laminations, held by two side plates, each of the same surface dimensions, but three-sixteenths inch thick. The whole is fastened together in both armature and core by means of rivets.

A series of holes was bored in the armature, perpendicular to the side faces. They are .089 inch in diameter and placed in rows at right angles to each other, five-eighths inch apart either way. Exploring coils of five turns each were wound in each pair of holes, making 29 conductors in each pole. Double silk-covered wire was used.

Before winding the armature it was placed in a coil oven and baked for 12 hours in order to rid it of all moisture. To insulate the sides of the armature and to keep the ends of the coils from coming in contact with the armature iron, side plates of wood fiber were put on, holes being bored in them corresponding with those of the armature. The winding was then made by threading the holes with the wire by means of a long, slim needle. Each coil was tested for grounds and short-circuit when the winding was completed.

The field winding of the magnet consists of eight coils, which were so designed that when placed in a series the magnet could be energized from 110-volt mains and when connected in parallel it could be used with as low a voltage as 7.5.

As it was very necessary to know the exact area enclosed by each exploring coil, the distance between the edges of the holes was accurately measured. The exact area was then determined where the holes were not parallel by finding the area of the parallel part and the area of the trapezoid, and

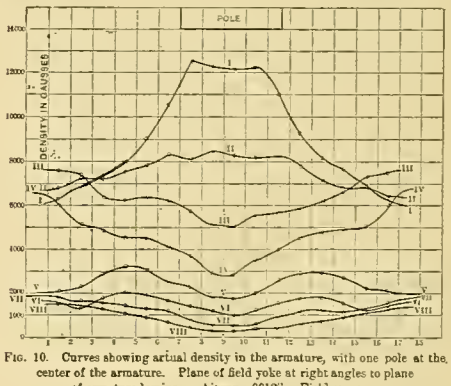

FIG. 10. Curves showing actual density in the armature, with one pole at the center of the armature. Plane of field yoke at right angles to plane of armature laminae. Airgap, .0612". Field ampere-turns, 1875.

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taking the sum. The holes were parallel to a depth of 1.72 inches, but for the remaining distance the area was a trapezoid. Knowing the area enclosed by each coil, corrections were made for the readings from each coil.

The armature was made deep in order to magnify the distortion of the lines of force which it was thought would occur. The distribution was studied in the armature alone, as the distribution in the armature core of a dynamo is the important element in calculating the core losses, whereas the field-core distribution is unimportant.

The terminals of the exploring coils were brought up to mercury cups in a board above the armature. These were arranged in such a way that any coil could be put, when desired, in series with a ballistic

1. Dr. John Hopkinson, "Philosophical Transactions" of the Royal Society, May 6, 1886; Gisbert Kapp, "Dynamos, Alternators and Transformers," p. 242; S. P. Thompson, "Dynamo-electric Machinery," p. 176; Ryan and Macomber, "Sibley Journal," Jan., 1897, p. 125.

galvanometer, the terminals of the galvanometer being simply placed in the two mercury cups containing the terminals of the coil.

Since the coils were wound in planes perpendicular to each other, they afford a means of determining the horizontal and vertical components of the density. Hence, the vector sum of the components at a given point is the actual density for that point, and the direction of the vector is the direction of the flux at the point.

The intensity of the magnetism at the center of the area enclosed by each four holes was determined by taking the mean of the readings from the (n)th and (n-1)th vertical coils and the mean of the readings of the (m)th and (m-1)th horizontal coils of the (y)th vertical and (x)th horizontal rows. The vector sum of these means gives the intensity at the point considered, and unless the curves for the horizontal and vertical components are extremely irregular from point to point, the method gives a very close approximation to the correct value.

The width of the face of the armature in contact with the poles was practically the same as that of the poles; hence the component of the magnetism perpendicular to the side faces was taken as zero, since the sides of the armature are parallel also. Correction was made for the distortion due to the holes containing the exploring coils as follows:

The actual area enclosed by a square having for its vertices the centers of four of the holes was found and the side of the equivalent square was determined. Then the ratio of the actual distance between the inner sides of the two holes from one another to the side of the equivalent square was taken as the correcting multiplier for the holes.

Correction for lamination was made as follows:

Weight of armature, if solid, 24,655.3 grams with wrought-iron at 480 pounds to the cubic foot.

Actual weight of armature. 21,437.64 grams. The ratio of these weights, .87, is the proportion of iron in the armature.

The gentlemen who constructed this apparatus also obtained a series of experimental records under various conditions of working, and their results are shown, in part, in Figs. 6, 7 and 8. The experimental work was completed by Messrs. F. Maze and C. Williams during the past spring, and some of the results obtained by them are shown in Figs. 9, 10, 11, 12, 13 and 14.

The results, as they are presented, indicate so clearly the conditions which obtained in each case that it is hardly necessary for me to add a word in explanation.

Fig. 8 is directly comparable with section A of Fig. 1. It represents the conditions existing in a machine in which the poles cover 65 per cent. of the armature, however, instead of 80 per cent., as in the case of Fig. 1, and differences are noticeable accordingly. For instance, the curve of maximum density distribution for Fig. 8 is plotted as curve (D), Fig. 3, and it is seen that the changes in the flux distribution are hardly so abrupt as in the case of curve (A). The ratio of the maximum to the minimum density of curve (D) is 9, while the ratio of the maximum to the minimum ordinates of curve (A) is 7. The ratio of the hysteretic loss that would occur in an armature having a core distribution like that of Fig. 8 to the hysteretic loss calculated on the assumption of a uniform density in the core is 1.23. Therefore, there is a difference of 23 per cent. in the experimental case, as compared with 35 per cent. in the calculated case. This difference is due to the fact that the shortest path in Fig. 8 is proportionally longer than the shortest path in section A of Fig. 1, and to the fact that the armature of Fig. 8 has an infinite radius, and therefore the areas of least density rank equally with the areas of high density in calculating the hysteretic losses, where, as in Fig. 1, the areas of least density are only 54 per cent. as effective as the areas of high density. The trace of the equal flux paths in Fig. 8 is made by the dotted lines connecting the pole-faces.

The curves of plates 7 and 8 are also very instructive in throwing light upon the matter. They bring out clearly the crowding of the lines of force together as they pass the corner positions of the poles, making the maximum density occur at the sides, rather than at the mid-point between the poles.

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The results shown in the figures so far discussed were obtained with the two poles of the yoke acting on the armature section as shown, and without any effort to produce cross-magnetizing armature effects.

In the succeeding figures the plane of the poles is at right angles to the plane of the armature laminæ. The armature is extended by side bars and a back bar into a rectangular construction across which the pole yoke bridges. It is this arrangement of the apparatus that is shown in the illustration of the apparatus.

Figs. 9 and 10 show the character of the flux

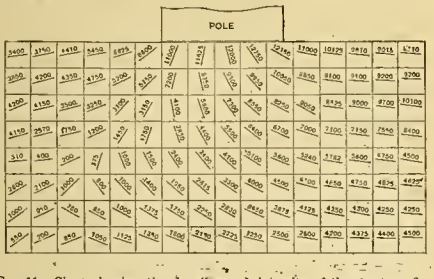

FIG. 11. Chart showing the direction and intensity of the armature flux, when one pole is acting at the center of the armature and influenced by the armature cross-magnetizing turns. Air-gap, .0613. Field ampere-turns, 1875. Cross-magnetising ampere-turns, 540.

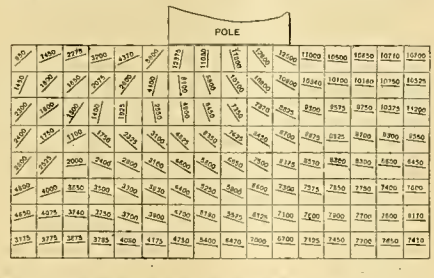

FIG. 13. Chart showing direction and intensity of the armature flux, when one pole is acting at the center of the armature, and the armature is powerfully cross-magnetised. Airgap .0613. Field ampere-turns, 1875. Armature cross-magnetising turns 1170.

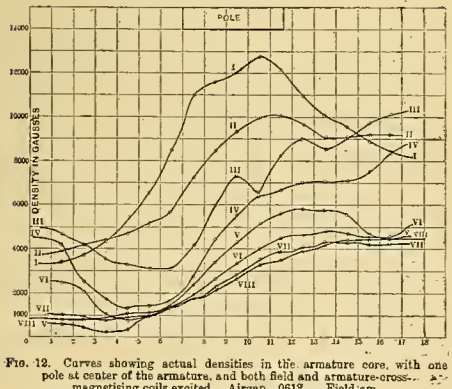

FIG. 12. Curves showing actual densities in the armature core, with one pole at center of the armature, and both field and armature-cross-magnetising coils excited. Airgap, .0613. Field ampere-turns, 1875. Armature ampere-turns, 540.

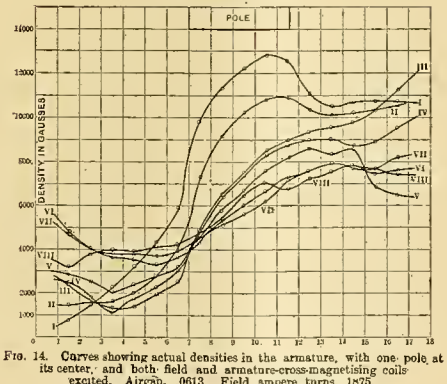

FIG. 14. Curves showing actual densities in the armature, with one pole at its center, and both field and armature-cross-magnetising coils excited. Airgap, .0613. Field ampere turns, 1875. Armature cross-magnetising ampere-turns, 1170.

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Fig. 1. It represents the conditions existing in a machine in which the poles cover 65 per cent. of the armature, however, instead of 80 per cent., as in the case of Fig. 1, and differences are noticeable accordingly. For instance, the curve of maximum density distribution for Fig. 8 is plotted as curve (D), Fig. 3, and it is seen that the changes in the flux distribution are hardly so abrupt as in the case of curve (A). The ratio of the maximum to the minimum density of curve (D) is 9, while the ratio of the maximum to the minimum ordinates of curve (A) is 7. The ratio of the hysteretic loss that would occur in an armature having a core distribution like that of Fig. 8 to the hysteretic loss calculated on the assumption of a uniform density in the core is 1.23. Therefore, there is a difference of 23 per cent. in the experimental case, as compared with 35 per cent. in the calculated case. This difference is due to the fact that the shortest path in Fig. 8 is proportionally longer than the shortest path in section A of Fig. 1, and to the fact that the armature of Fig. 8 has an infinite radius, and therefore the areas of least density rank equally with the areas of high density in calculating the hysteretic losses, where, as in Fig. 1, the areas of least density are only 54 per cent. as effective as the areas of high density. The trace of the equal flux paths in Fig. 8 is made by the dotted lines connecting the pole-faces.

The curves of plates 7 and 8 are also very instructive in throwing light upon the matter. They bring out clearly the crowding of the lines of force together as they pass the corner positions of the poles, making the maximum density occur at the sides, rather than at the mid-point between the poles.

The results shown in the figures so far discussed were obtained with the two poles of the yoke acting on the armature section as shown, and without any effort to produce cross-magnetizing armature effects.

In the succeeding figures the plane of the poles is at right angles to the plane of the armature laminæ. The armature is extended by side bars and a back bar into a rectangular construction across which the pole yoke bridges. It is this arrangement of the apparatus that is shown in the illustration of the apparatus.

Figs. 9 and 10 show the character of the flux distribution under the pole-face when the field coils are acting alone. In this case the symmetrical arrangement of the curves indicates that the flux divided about evenly and that the return paths to right and left have about the same reluctance. It is noticeable, here, as in Fig. 8, that the maximum density occurs at the pole corners, but it falls off very much more rapidly between the poles, as the arrangement of the apparatus admits of only about 14 per cent. of the armature surface being covered by the pole-faces. The bunching of the curves I., II., III. and IV. at the sides and of the curves V., VI., VII. and VIII. at the lower corners of Fig. 10 is due both to the presence of the rivets at the sides which hold the armature stampings together and to the fact, as shown by a special test, that the magnetic joints between the armature and end bars were better at the top and bottom than at the middle of the ends of the armature.

In Figs. 11 and 12 the effects of cross-magnetizing currents impressed upon the armature rectangle by means of coils wound around the armature and evenly distributed along its surface are very well exhibited. The armature ampere-turns were arranged to act in one direction only, so as to create a field in the armature rectangle without influencing the field yoke. The effect (see Fig. 12) was to markedly distort the core distribution in what would be the direction of rotation in a dynamo; to weaken the field under the leading pole-tips and to throw the flux toward the bottom of the core. Under the trailing pole-tip just the opposite effect is noticeable, and the special features discussed in connection with section C of Fig. 1 are all present here. In Fig. 11, the arrows bring out strongly the directions taken by the lines of force issuing from the pole-face. Inasmuch as they are compelled to separate equally to the right and the left, the superposition of the horizontal components of the armature flux upon the pole-field vectors is well illustrated, and a strong similarity can be traced between the effects shown here and those previously calculated.

By doubling the cross-magnetizing effect of the armature ampere-turns all of the effects just noticed were brought out much more strongly. From Fig. 14 it will be seen that the flux density at the lower right-hand corner of the armature was raised to two-thirds of the value of the flux in the upper courses, and that on the left-hand side the flux has been thrown into the lower courses to so great an extent that the density is four times greater at the bottom of the armature than it is in the left-hand upper corner. In this latter case the total flux permeating the armature core is about 2.2 more than that set up by the field ampere-turns acting alone, or the armature ampere-turns set up through the armature rectangle, a field equal to 1.2 times the flux set up in the field coils by the field ampere-turns. The conditions here present are similar to those existing in the older types of dynamo machines in which the field under the leading pole-tips became zero or was reversed by the cross-magnetizing effect of the armature ampere-turns.

When the armature ampere-turns were alone excited it was found that the distribution of the flux over a section of the armature core, taken at row number 9 or 10, and at right angles to the direction of the flux, was perfectly uniform.

Use of the Electromagnet in Eye Surgery.

Serious attention is now paid by surgical authorities to the use of specially arranged electromagnets to attract particles of iron or steel embedded in the eyeball. William A. Fisher, M. D., treats the subject in an interesting article in the Journal of the American Medical Association, from which the following is an extract:

"We have reports of operations with the Haab magnet that are startling, and one would think that the only thing necessary to record a brilliant operation would be a patient with a piece of metal in the eye and a Haab magnet that we could place close to the patient, touch the button, and remove the piece of metal from the magnet. In fact, we have a report of two cases where the magnet was successful in removing metal from the interior of the eye where the eye and the magnet were separated two inches from each other. In these two cases the patient was slowly moved toward the magnet, and when the eye was separated two inches from the magnet the metal flew from the eye to the magnet. I cannot say that such magnets have never been made, but the ones now on the market have no such power. If they had that much attraction and no rheostat, I would not like to subject one of my patients to such a force. In the description of its use we are told to place the patient in an operating chair which is freely movable in all directions, then gradually approach the magnet with the patient. No such thing is necessary with this magnet. We place our patient in a comfortable position in an operating-chair, or on an operating-table, arranging the magnet and patient so the tip of the magnet will be in the line along which you expect to draw the foreign body. When all is ready and the tip of the magnet is in contact with the cocainized eye, we gradually turn on the current.

"Many think the magnet impracticable if the metal in the eye happened, as is often the case, to be a long piece of iron or steel, and lying crosswise to the magnet. The first motion that a piece of iron or steel would make that was lying crosswise in the eye would be to turn itself, and the point of the metal would aproach the magnet. We place the patient and magnet in position, then touch the tip of the magnet to the cocainized eye before using any electricity. If the metal entered the eye back of the lens, we should, if possible, enlarge the opening and put the oval tip of the magnet into the opening and gradually turn on the current. If successful, we should find the metal adhering to the magnet. If we fail the first time, we can turn off the current, and quickly turn on and off, and in this way dislodge the metal. If we cannot find the original opening, there is no objection to making an opening in the sclera back of the lens. If we succeed in removing the metal in this manner, we are less liable to destroy the vitreous than we would be if we introduced a small magnet into the vitreous, especially if we introduced it more than one time, or in more than one direction, as we usually do."

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CIRCULATION, 20,000.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 17th to 21st.

Chicago Exposition of Electrical Arts, Tattersall's, September 25th to October 9th.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

The "naming of the horseless carriage" has been a hot-weather topic of discussion for several of our contemporaries, notably the Electrical Review and the Chicago Record. Aside from publishing wide the fact that the horseless carriage is already pretty well named by the word "automobile," the efforts of the journalistic linguists have been principally noteworthy in exciting the facetious word-maker and the ambitious amateur in the same line. These gentlemen produced several glittering gems from their mines of thought, such as "antihorse," "equinenit," "autema," "autogo," "voltcar," "moby," "bacrotom," "autovolt," "electrola" and "telespin." The inventor of the last-named, who signs himself Pat Mulhern, delivers himself in the Chicago Record to the following effect:

Who is there to whom it does not occur that the wheels on these carriages actually "spin?" And all know 'tis by lightning; hence, "telespin" or "telspin."

We fear that Pat is fooling with us. We will have none of him. As for the Electrical Review, it has pledged its fealty to a word made for it after anxious search. This word—it is "electromobile"—is now the fond device on its banner, and the flag is nailed to the mast. But alas! popular usage knows it not.

At last it is possible to say a good word for lightning, provided, of course, the story upon which this is based prove true, and there should be no question of veracity, since the source of information is the Sun, whose motto is: "If you see it in the Sun it's so." It is claimed by the veracious chronicler that a lightning stroke restored vigor to a limb that had been useless for 13 years. Here is the story as it appeared in the Sun:

East Brookfield, Mass., July 7.—A remarkable freak of lightning occurred here yesterday when a sudden shock restored to its old-time vigor the left arm of Eli Forbes, which had been useless for 13 years on account of rheumatism. While he was sitting at the window yesterday a thundershower came up and with it were two sharp flashes of lightning. With one of the tremendous crashes Mr. Forbes felt a sharp pricking of his flesh and tingling in his bones, and with a jerk his left arm shot violently forward from its cramped position. The shock was over in a flash and Mr. Forbes felt his left arm bristle with vitality and tingle with vigor. To his delight he found he could use the arm as well as ever.

It will now be in order for persons suffering from similar troubles to expose themselves during electrical storms. It may even develop into a fad and be recognized as good form to rig up a lightning-rod attachment, which may be run up whenever there is prospect of atmospheric disturbances. The electric-belt man and other fakers of this class will have to seek new fields—nothing but the real article will be accepted hereafter by the afflicted.

Some interesting experiments on collecting atmospheric electricity are making by Prof. Alexander G. McAdie of the United States Weather Bureau at Washington, who is developing the idea of Franklin's celebrated kite-flying test to an extent not hitherto attempted. Professor McAdie uses box kites connected to the receiving apparatus by piano wire and secures results from cloudless skies, showing that the differences in potential of the atmospheric strata are not wholly due to storms. Measurements are taken on voltmeters, and it has been found that the observed electromotive force of the higher strata of the air is higher than of the lower and denser layers. The kite has reached an elevation of a mile or more, it is said, and enough current has been received to run a small toy motor. Special efforts are made in thunderstorms, and at such time it is said that as high as 4,000 volts has been recorded by Prof. McAdie's apparatus. A local chronicler states that on the first occasion when the Weather Bureau experts succeeded in keeping a kite in the air through a severe thunderstorm the phenomena were somewhat alarming. There was an incessant stream of sparks coming from the wire attached to the kite, accompanied by a sizzling noise when a finger was held near, and it seemed certain that the instrument would be burned out. In fact, the disturbance was so great that the observatory was believed to be threatened, and it was proposed to cut the wire and let the kite go. This, however, was more easily said than done, inasmuch as contact with the wire meant a severe shock; but, finally, one of the party in charge broke it. As he did so he saw a brilliant flare of light about the recording instrument and felt a shock as of a blow across the arms.

There is some hope that these experiments may lead to a possible result in utilizing the vast store of electricity in the atmosphere, or in the ether, to do useful work without the interposition of mechanically driven "generating" apparatus.

Electrical men in the United States and all other countries will extend the sincerest sympathy to their Italian fellow-workers in the calamity by which the electrical exposition at Como in honor of the Volta centenary was destroyed. At first the news was doubted; it seemed incredible that the destruction by fire could have been as complete as reported. But later reports confirm the first brief dispatch; the exhibition was wiped out by the flames. Some consolation is afforded by the statement that the original Voltaic pile and many historic manuscripts were saved.

Despite this crushing disaster, it is reported that the original programme of exercises in commemoration of the 100th anniversary of Volta's great discovery will be carried out—minus the exhibition, of course. This determination shows the devotion and courage of the Italian electricians and will excite admiration everywhere.

We hope that it is not true that a short-circuit in the wiring caused the fire. Where electrical conductors are present, there is a disposition on the part of many uninformed persons to jump to the conclusion that electricity causes a fire. It would seem probable that in an electrical exposition, of all places, the construction work and inspection would have been so carefully done that the danger of fire from electrical causes would have been very remote. Additional information on this point will be awaited with interest.

Readers of Chicago papers who use telephones were alarmed last week by the announcement that infectious disease germs had been found in telephone transmitters taken from actual service in the Chicago Telephone company's system. The remarkable similarity in the phraseology of the announcements in the several papers, coupled with the statement that a patent germ-killer had been discovered, awakened suspicions that the object of the investigation was not entirely disinterested. Inquiry disclosed the fact that the sensation was the work of promoters who hoped to profit by the fears produced in the minds of the public; in a word, the whole scheme was a cheap trick and a thoroughly discreditable piece of business.

It is not necessary to consider the merits of the invention which this scheme was intended to introduce. It is sufficient to know the means employed to form a correct estimate of the character of the project. Its promoters cannot hope to secure and retain public confidence by resorting to such deception. They cannot plead ignorance, as they were familiar with the work that had already been done by the Chicago Telephone company and other concerns, especially the elaborate series of tests that had been made by the Boston Health Department. All of these investigations showed that fears of spreading infectious diseases in this manner were without foundation. Men who have been associated with the development of the telephone movement from the beginning have yet to learn of a well-authenticated case of this kind, and yet the Bell company has had the danger carefully investigated by the most eminent scientists of the country.

In view of these facts the position of the Chicago alarmists cannot be too severely condemned. They have forfeited every claim to consideration and they should be made to feel the displeasure of the public. This is a subject upon which the Bell and anti-Bell interests may heartily join with the general public. To permit such deception to pass unnoticed would seriously affect the development of the telephone industry.

FOREIGN ELECTRICAL NOTES.

The Portuguese minister for foreign affairs invites tenders for the installations of electric-light, telephone, etc., at Beira, on the east coast of the Portuguese territory in South Africa.

Under the title of the Siam Electricity company (limited) a company has been formed in Copenhagen, with a capital of $170,000, with power to increase to $500,000. The capital is principally Danish. The company has secured a concession for electric undertakings at Bangkok, and has bought certain rights at Bangkok, and it is intended to extend operations also to other parts of Siam. Burmeister & Wain of Copenhagen and Siemens & Halske of Berlin will jointly supply the plant.

The New Zealand Herald states that P. M. Hansen has succeeded in arranging in London for a very powerful and influential company to take over and work certain tramways in the Australasian colonies. The intention is to make a beginning with the Auckland, New Zealand and North Shore trams. It is intended to work the tramways entirely by means of electricity. The company will endeavor successively to acquire the tramway concessions in Wellington, Christchurch and Dunedin, and will then cross the Tasman Sea and invade Australia, beginning with Adelaide, South Australia.

About 120 concessions have been granted for the building of roads in every kind of place in Switzerland. These roads, when completed, will have a length of about 950 miles. About one-half of these will be equipped with electricity. The motive power of most of the existing lines is steam, electricity coming next in order. Water power is used to some extent and on a few of the lines horses do the work. Only one line is run by compressed air —the street-car system in Berne. This power is costly and the machinery cumbersome, taking up the space of the entire front platform. Switzerland has an area of 15,981 square miles and 2,500 miles of railway. There are 28 main steam trunk lines, 24 narrow-gauge lines, 10 cog-wheel railways, such as those which surmount the Rigi and Pilatus and run from Interlaken to Schynige Platte, 20 cable lines, like that which connects Lausanne and Ouchy, and 26 street-car lines.

The Brazilianische Elektricitäts-Geseilschaft, a recently formed organization of German capitalists, has just been authorized to operate in Brazil. The articles of association state that the object of the company is to construct and exploit in Brazil and other countries of South America all kinds of electric installations and to acquire existing electric traction, lighting or telephone plants or concessions. The capital of the company is equivalent to $1,250,000, divided into 5,000 shares of 1,000 marks each, of which 50 per cent. is payable on the constitution of the company. The following-named companies are signatories to the articles of incorporation: Deutsche Bank, Heineman Electrical company, Mitteldeutsche Credit Bank, Siemens & Halske company, Schlesischer Bankverein, Bergische Markische Bank, Oberheinische Bank and Thoedor Wille. "We understand," says a Brazilian paper, "that among other undertakings, the Rio de Janeiro telephone service will be undertaken by this company. There is no doubt of a grand field for such enterprise in Brazil. Few countries offer such advantages for the establishment of electric power. It is impossible to get any distance from any of the larger cities in Brazil without finding abundant water supply and practically inexhaustible power. We firmly expect that before many years are over the Central and many other railroads that now use steam will be driven by electricity, and think that this new company could not do better than give its attention to the subject. With millions of horse power running to waste at our door, we are still compelled to import fuel at an enormous cost. When cheap traction is guaranteed by the use of the power nature has so liberally bestowed, the greatest problem of the time will have been solved. It is in the direction of electrical development that we expect to see the metamorphosis of Brazil brought about. Let us begin with the Central railroad and all the rest will follow suit. There is power enough wasted on the Little Pirahy to work the whole of the traffic up the Sierra to Barra and from thence onward. The only difficulty on the Central seems to be to keep away from rivers that could supply 100,000 times the power wanted to drive them—a simple waste of raw material."

Trade with China.

[From the Journal of the American Asiatic Association.]

Beyond all these questions of the future capacity of China to consume our surplus products is the present and pressing question of who is to equip these teeming millions of people and their still undeveloped country with the appliances of modern civilization. Who is to build their railroads, set up their electric plants, furnish the machinery to work their mines, and generally help the China of to-day to get abreast of the improvements of the age of steam, of whose existence she is only becoming conscious? The work must and will be done by somebody, and it is one from which we cannot afford to be excluded.

It has been said by one who knows the country well: "China is about the only part of the world where the engineer has not set foot, and yet there is no part of the world where his services are more needed or would be better rewarded." The competition to furnish the appliances for the transformation of China is fairly under way, and American skill and capital are well represented in the struggle.

There would be no misgivings about the ability of our citizens to hold their own in such a contest were the question merely one of individual capacity. But railroad enterprise in China has already assumed the character of political aggression, the transportation route being valued less as a path for commerce than as furnishing an opportunity to convey troops and munitions of war into the heart of the empire. This is a phase of the contest for a place in China with which the United States can, obviously, have nothing to do; but it is hardly one of which our people can afford to be merely idle spectators.

A. A. Dion, President of the Canadian Electrical Association.

The newly elected president of the Canadian Electrical association is a practical electrician who has come up with the development and expansion of the industry. Like so many of the successful men engaged in the business in this country, Mr. Dion gained his early experience in a telegraph office. He was born in the city of Quebec and was educated there. He became a telegrapher at an early age and continued in this capacity until attracted by the development in the lighting and power transmission branches of the business. Always a close student and intelligent observer of events, Mr. Dion

A. A. DION.

recognized the vast possibilities in the new fields and kept abreast of the advances that were constantly being made there. He is now general superintendent of the Ottawa Electric company, one of the most progressive concerns in the Dominion. Mr. Dion is a member of the American Institute of Electrical Engineers and takes a lively interest in the work of that organization. He has contributed several excellent papers of a practical nature to the literature of the profession, the latest being a very comprehensive treatise on "Meters and Meter Rates," which was read before the convention of the Canadian Electrical association just closed at Hamilton.

The Electric Light in Manila.

In Manila the central-station plant is near the center of the city. The Pasig River, which runs through the city, divides the old from the new town, and the current is carried across the river by three bridges on steel poles, the lines being tapped to supply lights to each bridge. There are 450 steel and 1,400 wooden poles, and the lines are carried in oil-filled porcelain insulators. The Manila Electric Light company has a contract to light the streets for 20 years, 16 of which are still to run. General Otis has taken over the responsibilities of the contract, says Industries and Iron of London, and is paying the electric-lighting bills for the streets. The original contract provided for 140 2,000 candle power arc lamps and 1,000 20 candle power series incandescent lamps at $60,250 a year. The arcs are 50-volt lamps, 20 in series, on a 1,000-volt circuit. The number of street lights has greatly increased. On wide streets the steel poles are in the middle, and it is provided that the lights should be switched in 20 minutes after sunset and off 20 minutes before sunrise. There are about 6,000 incandescent 16 candle power lamps, running on 100-volt alternating-current circuits. The charge is $1.50 (Mexican) a month for a 16 candle power lamp, burning half the night, and $2 for an all-night lamp. The central station is equipped with six compound, condensing engines of 300 horse power each, 10 alternating-current generators of 2,000 volts, of 60 kilowatts capacity each, and four 65-light 2,000 candle power arc dynamos, running at 3,250 volts each. The capacity of the station is 12,000 incandescent lamps and 260 arc lamps.

Chicago's Electrical Exposition.

Preparations for the electrical exposition to be held in Chicago next fall are being made with zeal and intelligence. The officers of the National Exposition of Electrical Arts company, which originated and will manage the exposition, are working hard to make the exhibition a success. It is proposed to have on exhibition as many electrical novelties as possible, one of the principal objects of the company being to have exhibits to satisfy popular curiosity as well as the questionings of scientific men.

Tattersalls' building, which has been selected for the exposition, has a floor space for exhibits 147 feet by 280 feet. Plans are now being drawn under the supervision of Mr. N. J. Heinbach, the president of the exposition company, for the remodeling of the entire front of the building. The style of architecture will be Roman and the materials of construction will be of a similar nature to those used on the World's Fair buildings.

Contracts for the exhibition booths are being closed rapidly and the prospects are that the floor of the building will be well filled with the exhibits. Inquiries are coming into the office of the company daily and much interest is shown by the electrical men of the West. Contracts have been closed with representative firms in Cincinnati and New York, some of which exhibited in the recent electrical show at Madison Square Garden. As the exhibition and annual meeting of the American Street Railway association will be held in the same building a week later (October 17th to 20th), arrangements have been made to have a large number of the convention exhibits placed in the hall in time for the electrical exposition. Nearly one-half of the building will be given up to these exhibits, which will form a very interesting and instructive portion of the exposition.

One of the most popular features of the show, undoubtedly, will be the exhibits of horseless carriages. It will be confined to a space 147 by 25 feet at the south end of the hall, where a track will be built for exhibiting the vehicles in motion.

Special arrangements have been made with the Chicago Edison company whereby exhibitors can secure such power as may be required. The interior of the building will be handsomely decorated and some 5,000 incandescent lamps will furnish the light. Outside the hall Sixteenth street, from State street to Clark street, will be brilliantly illuminated by a canopy of incandescent lights.

The period of the exposition, September 25th to October 9th, comes at a time when the city will be full of visitors to witness the autumn festivities and the laying of the corner-stone of the new postoffice. Bands will be in regular attendance and special features are being arranged for the different days. It is affirmed that Thomas A. Edison will be present and deliver an address on "The Progress of Electricity," and it is also stated that President Diaz of Mexico will take a prominent part in the exposition.

Sad News from Italy.

The Chicago Tribune printed this telegraphic dispatch:

"Como, Italy, July 8.—The Volta electrical exhibition has been entirely destroyed by fire due to defective electric wires. Many relics of Volta perished."

The Rome correspondent of the Chicago Record adds this information: "In taking stock of salvage at Como it is found that a fair number of relics of Count Volta's experiments and researches have escaped the fire that consumed the buildings of the electrical exposition. Among these are the original Voltaic pile and many manuscripts. Despite the destruction of the exhibition, the original programme in commemoration of the life and work of the physicist is being carried out."

Street Cars with Whistles and Telephones.

[From the Minneapolis correspondent of the Western Electrician.]

The new street cars to be used on the interurban line between St. Paul and Stillwater will be unique in their equipment. They will have compressed air for brakes and whistles, to be supplied by a small motor, operating an air pump. The air whistle will be used in the country, where the cars will be run at a high rate of speed. Each car will also be equipped with a telephone, with 50 feet of wire and a switch plug. At intervals of a quarter of a mile there will be places where the conductor can cut in on the telephone wire between St. Paul and Stillwater and communicate with the power house or car barn.

Death of H. H. Brooks.

Many friends, both East and West, of Herbert H. Brooks, the general manager of the American Circular Loom company of Chelsea, Mass., will greatly regret to learn of his death on July 9th, at his home in West Medford, Mass. Mr. Brooks had been a sufferer from consumption for several years and had made trips to Mexico, the West Indies and other points in the vain effort to restore his health. He was about 40 years of age and unmarried. Mr. Brooks had been connected with the American Circular Loom company since its inception, and had much to do with the perfecting of its well-known form of interior conduit, which his brother, now deceased, invented. He had an attractive personality and was thoroughly well liked.

DEVELOPMENT OF THE TELEPHONE FIELD.

Bell Interests in Massachusetts.

[From the Boston correspondent of the Western Electrician.]

Rumors of a deal whereby the Southern Massachusetts Telephone company is to be absorbed by the New England have been current lately here. Officials of the New England Telephone and Telegraph company, while not denying the proposed absorption, are disinclined to discuss the matter at present, and simply assert that the publication is somewhat premature. Matters have progressed to the point where stockholders in the Southern Massachusetts are offered in exchange on the basis of four shares of New England stock for three shares of Southern Massachusetts. The offer now made in direct form has been submitted informally to a majority of the stockholders, and about 90 per cent. of the more prominent ones have signified their assent to it. The movement is considered practically certain of success, therefore. The Southern Massachusetts has a capital of $600.000, and for this $800,000 worth of new shares will be exchanged. The New England company ordinarily pays six per cent. in its annual dividend disbursements, and the Southern Massachusetts has been paying eight per cent. The latter system will probably be made a division of the absorbing concern, with the superintendent and subordinates retained, as at present.

The American Bell Telephone company only holds a minority interest in the Southern Massachusetts company, majority control being held by New Bedford investors. The system serves the city of New Bedford, also Fall River, Taunton, Brockton and other places throughout that section of the state. The Bell has a minority interest in the Providence and Southern New England companies, as the Rhode Island and Connecticut systems are named.

The stockholders of the New England Telephone and Telegraph company having increased the capital stock from $12,000,000 to $15,000,000, the directors of the company have ordered that 9,980 shares be offered to stockholders at par, $100. The issued capital now amounts to $11,976,000. President Sherwin says: "The great increase at present in the number of our subscribers, due in part to the low rates at which the party-line and measured service is furnished, has demanded a more rapid enlargement of our facilities than ever before." Each stockholder of record at the close of business Monday, June 26th, will be entitled to one new share for every 12 then held. The right to subscribe will expire at 1 p. m., July 22d. Payment for full shares equal to one-half of the shares subscribed for must be made to Treasurer Driver by August 16th, and for the remainder on November 16th. The compan ywill neither buy nor sell "rights." The American Bell company, owning about 51 per cent. of the stock, will take $1,500 of the new stock, it is stated. The proceeds of the sale of the $2,000,000 in bonds issued by the American Bell company will be used, in part, in the purchase of New England company stock.

Samuel J. Powers, special attorney of the American Bell Telephone company, is a candidate for nomination for Congress from the eleventh congressional district in Massachusetts.

The Worcester Telephone company of Worcester, Mass., has filed its certificate of incorporation. The authorized capital stock is $200,000, par value $100. Henry F. Harris (president), William P. Searles (treasurer) and Henry S. Pratt are the directors. The purpose of organizing is stated to be the buying or otherwise acquiring, constructing, maintaining, selling, leasing and operating public and private telephone and telegraph lines, both within and without the commonwealth.

Government Ownership in England.

Discussing Mr. Handbury's telephone bill which is now under consideration in Parliament, Mr. I. N. Ford, the London correspondent, says that the National Telephone company, perceiving that its business is doomed in the course of a few years, is naturally anxious to sell its property and plant to the government at the earliest possible date and on the most favorable terms. The purchase of the telegraph system is a precedent upon which it depends in forcing upon the government a stock-exchange valuation of its plant; but that was a notoriously bad bargain for the Postoffice. In order to promote this object its directors have influenced certain municipal bodies to declare in favor of the nationalization of the telephone service, and they have probably had something to do with shaping the local license clause of Mr. Hanbury's bill. As it stands, it enables the municipal authorities to compete with the monopoly until 1911, but leaves to the Postoffice at that date the option of deciding whether it will buy the local government's or the company's telephone system. It is doubtful whether the municipalities can get their money back in 11 years, and it is reasonably certain that they ought to have the option of remaining permanently in the telephone business if they desire to do so. Public interest will be promoted if the bill be modified so as to leave a free field for an alternative telephone service throughout the country. The monopoly will then surrender at discretion and the problem of nationalization or municioalizing the telephone business will readily be worked out.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The new telephone exchange in Aitkin, Minn., put in by Herman Moork, is about completed.

The annual meeting of the Northwestern Telephone Exchange company was held in Minneapolis June 20th. President Glidden says the company does not fear the competition of the Mississippi Valley Telephone company.

The Mississippi Valley Telephone company expects to have its instruments connected up with the switchboard in Minneapolis early in July.

It is understood the Iowa Telephone company will inaugurate a war on rates at Elkader, Ia., on July 1st. The Standard Telephone company is the competitor there.

The projected Brodhead telephone exchange for Brodhead, Wis., is practically assured. Active work will be prosecuted as soon as possible.

President Glidden of the Wisconsin Telephone company at Lowell, Mass., sends a denial to Madison, Wis., that he ever wrote to J. Crawford Harper at Madison making an offer for the Dane County Telephone company's system. Mr. Crawford admits he received no written proposition from Mr. Glidden, but says he did receive a proposition verbally from an agent of Mr. Glidden, named Webster.

The Little Wolf River Telephone company is an applicant for a telephone franchise at Fox Lake, Wis.

Enough stock has been subscribed in the new telephone company at Monroe, Wis., to assure its success.

W. W. Epps has been elected local manager of the Ottumwa Telephone company at Ottumwa, Ia. The company has just received a new switchboard and 4,500 feet of cable. Many other improvements are projected.

The Winona Telephone company of Winona, Minn., has accepted the proposition of J. D. Hollowell to erect a building for its central office.

W. A. Strom of Hector, Minn., has secured a franchise for a telephone exchange at Olivia, Minn.

The Pine Bluff Central Telephone company of Mount Horeb, Wis., has made arrangements with the Dane County Telephone company of Madison, Wis., to exchange messages.

The Central Telephone company proposes to connect with Pocahontas, Ia.

The Greene and Western Telephone company has transferred its headquarters from Mason City, Ia., to Greene, Ia.

The switchboard of the Spencer Telephone company at Spencer, Ia., was set fire by lightning, but was quickly put out. The damage will amount to $150.

The Standard Telephone company is preparing to cover Fayette County, Ia., with toll lines.

The Minnesota Central Telephone company of Willmar, Minn., has bought the stock, franchises, etc., of the Redwood Falls Telephone company at Redwood Falls, Minn. A local system will be put in at Redwood Falls.

The National Automatic Telephone company will establish an exchange in Langdon, N. D.

The Billings and Musselshell Telephone company of Billings, Mont., expects to have its line to the Musselshell completed soon.

The Central Telephone company has ordered a modern switchboard for the exchange at Manson, Ia. It will have self-restoring drops and automatic ringers.

Frank Fee is installing a telephone exchange at Hartley, Ia.

The Duluth Telephone company of Duluth, Minn., made a secret proposition to the County Board to make a rate of one-quarter the present figure for 12 telephones, provided the county enters into an agreement for three or five years and agrees to use no other telephone than that of the Duluth Telephone company. The board is reluctant to make such a contract.

Cleid H. Smith is rushing work on the new telephone exchange at Odebolt, Ia., and will have toll lines to the towns of Kiron, Deloit, Arthur and Schleswig. A line will probably be built to Boyer.

The Rocky Mountain Bell Telephone company is extending its wires from Sheridan to Virginia City, Mont.

The Litchfield (Minn.) Telephone Exchange company contemplates extending toll lines to the country.

The long-distance telephone line has now reached Carrington, N. D.

E. B. Smith, general superintendent of the Iowa Telephone company at Davenport, Ia., has gone to Boston to confer with the officials of the Bell company on the subject of improvements to the system throughout the state.

Lakeville, Minn., is soon to have telephone connection.

S. M. Elwood has been granted a franchise for a telephone exchange at Sac City, Ia. Judge Elwood has offered the franchise to the Sac City Electric Light company, which declined, and he proposes to put in a system himself.

The Ogden (Ia.) Telephone company now has its new exchange in working order.

The Duluth Telephone Exchange company is the successor of the Duluth Telephone company at Duluth, Minn., and has a capital stock of $500,000. The company is a Bell concern.

The Douglass County Telephone company of West Superior, Wis., will soon connect with the long-distance system of the Wisconsin Telephone company. The American Telephone and Telegraph company is also building a long-distance connection through Minnesota from Minneapolis, so that the head of the lakes will have two systems of connection with Chicago and the East.

The Dane County Telephone company now has connection with Riley and Cross Plains, Wis., through Mount Horeb.

Allen Rossiter, superintendent of construction for the Green Bay railroad at La Crosse, was dragged from the top of a freight car by a sagging telephone wire and killed.

Webster City, Ia., will vote July 11th on granting a franchise for a telephone exchange to A. W. Chamberlain. There is already one independent exchange in Webster City, and there is a good deal of doubt as to the advisability of having a second exchange.

The Forsyth and Lame Deer Telephone company has been formed at Forsyth, Mont., to build a telephone line to the Lame Deer Indian agency.

S. Carpenter and Henry Addie of Cresco, Ia., recently inspected the telephone system in Albert Lea, Minn., and contemplate installing a similar system in Cresco.

The Northwestern Telephone company of Rush City, Minn., has completed connection with Princeton, Minn.

The Northwestern Telephone Exchange company expects to have the St. Paul exchange completely rebuilt by August 1st and a new switchboard installed. During the progress of changing from one system to another the service has been imperfect, but the company expects to have comparatively few complaints when the new exchange is working.

The Lewistown (Mont.) Telephone company has been formed with $10,000 capital stock to operate the lines from Lewistown to Gilt Edge and to Oka, and also the exchange in Lewistown.

The Greene and Western Telephone company of Greene, Ia., is reported at Albert Lea, Minn., to have secured a right-of-way into Minneapolis and St. Paul, and it is thought the company will extend its lines to the Twin Cities this summer and fall.

The Glencoe and Lester Prairie Telephone company has completed a line between those towns in Minnesota.

The Sioux Rapids Telephone company of Sioux Rapids, Ia., is about to install a telephone exchange.

C. G. Cockerill is preparing to install a new switchboard for the telephone exchange in Jefferson, Ia.

A local stock company is being worked up at Casselton, N. D., to install an automatic telephone system.

The Southern Electric Telephone company of Minneapolis has been granted a franchise for a telephone exchange at Tracy, Minn.

The Southern Minnesota Electric company will establish a telephone exchange at Sleepy Eye, Minn., if sufficient patronage can be secured.

The Northwestern Telephone Exchange company is building a toll line east from Crookston, Minn., to Red Lake Falls and St. Hilaire, Minn.

The Mesaba Telephone company of Virginia, Minn. has been incorporated. The company is completing a metallic circuit, covering the various towns on the Mesaba range.

The Litchfield Telephone exchange of Litchfield, Minn., will extend its toll line from Mannannah, Minn., to Eden Valley, and also from Litchfield to Greenleaf, Strout, Corvuso and probably Cedar Mills.

EXTENSIONS AND IMPROVEMENTS.

The new telephone line has been completed between Guinda and Rumsey, says the Woodland (Cal.) Mail, and connection will be made with Capay.

A new telephone exchange, to be known as the Madison Square exchange, is to be established at No. 30 East Twenty-ninth street, New York. The purpose of the new exchange is to relieve the Eighteenth and Thirty-eighth street exchanges, and 1,100 subscribers are to be transferred from those exchanges to the new one, 500 from the former and 600 from the latter. Sixty operators will be employed in the new exchange. The common battery system, the same as is now in use at the Riverside and Harlem exchanges, will be used at the Madison Square exchange. The opening of the new exchange is expected to facilitate the general telephone business in the central part of the city.

MANUFACTURERS AND DEALERS.

The Electric Appliance company of 92 and 94 West Van Buren street, Chicago, is making a special point of the fact that it is manufacturing its own telephones. It has felt from the beginning of the independent telephone business that it wanted to have only the best apparatus, and to be absolutely sure that it had the best it has been manufacturing its own goods with the greatest possible care and with large facilities. The large volume of this branch of the business indicates the wisdom of the policy the company has followed in this matter.

That Telephone Ordinance.

[From the Chicago Record.]

The Illinois Telephone company ordinance was supported in the City Council by a large number of aldermen whose motives are believed to have been good. The ordinance seemed on its face to be for the benefit of the people, for it gave promise of telephone service at much lower rates than now prevail. A considerable number of aldermen did not like the idea of having two telephone systems in the city, and had the Chicago Telephone company been willing to make a reasonable proposition to its customers in regard to rates, they would have stood out against granting a franchise to a new corporation. But the Chicago Telephone company was obstinate, and, in view of the demand for cheaper service, the aldermen who may have had misgivings about the new ordinance felt that they could not oppose its passage.

However, subsequent events seem to prove that the passage of the Illinois Telephone company ordinance is likely never to be of any benefit to the public. There are as yet no signs that the new system is to be constructed, whereas there have been suspicions for some time that the franchise was for sale. This attempt to introduce competition in telephone service is turning out as did previous efforts to benefit the public by granting franchises to alleged competing lighting companies. In the end the rival concerns were consolidated and the consumers of light were compelled to pay interest and dividends on so many more securities.

This experience with the Illinois Telephone company franchise ought to be the last of its kind. The city should take its stand squarely in line with the position that the telephone business, the lighting business, the street-railway business and all others of the same sort ought to be monopolies, and it should proceed to deal with them acordingly. The companies engaged in enterprises of this kind should be assured of immunity from competition. That done, the public authorities should undertake to regulate charges and quality of service in the interest of customers. The Legislature should be prevailed upon to authorize the council to regulate charges, and then the council should proceed to exercise the authority conferred upon it. That is the proper way to deal with the local monopoly problem, until such time as the public shall be prepared for municipal ownership of public utilities.

TELEPHONY IN THE SOUTH.

The Carrollton (Ky.) Telephone Exchange company has been incorporated by R. M. Parker and others, with a capital stock of $5,000.

The Henderson (N. C.) Telephone company, of which F. C. Toepleman is general superintendent, will construct an exchange at Littleton.

The Cumberland Telephone and Telegraph company will put in a telephone exchange at Wartrace, Tenn., with John E. Russell as local manager.

The Rutherford (N. C.) Telephone company has been incorporated for the construction and operation of telephone lines; capital stock, $10,000; incorporators, J. C. Mills, D. F. Morrow and M. O. Dickerson.

The Mooresville and Waco Telephone company (capital stock, $1,000) has been incorporated in Texas for the construction of a telephone system from Mooresville to Waco; incorporators, J. E. Brown, Robert Brown, P. A. Clark and others.

TELEPHONY ABROAD.

A telephone convention between France and Italy has been signed, subject to ratification by the parliaments of the two countries.

The Imperial Diet of Japan last February voted to expend $12,800,000 within the next seven years for the improvement of the government telephone system, and a young electrical engineer named Rinja Nakayama has been sent to the United States for the purpose of investigating the latest inventions and improvements along that line. Japanese electricians will do all the work.

Ministerial Councilor Professor Herrmann, the inventor of the postal card, has just suggested to the Vienna postal authorities the introduction of a combination of postal card or letter with the telephone and telegraph service. He suggests that a special postal card be authorized, to be posted in the ordinary way, the contents to be transmitted to the address by the receiving postmaster, either by telegraph or by telephone, as may be most convenient. The original then would be delivered with the ordinary mail, in verification of the message sent by wire. The Vienna Chamber of Commerce supports the innovation, which it declared at its meeting recently to be a cheap and useful means of bridging the gap between the letter and the telegram.

Franchises Required.

The Common Council of Niagara Falls, N. Y., recently notified the Bell company to get a franchise or take down its wires and poles, and now the Western Union Telegraph company is in receipt of a similar notice.

Operation and Maintenance.[1]

By E. B. Fisher.

This topic, "Operation and Maintenance," was assigned to one of the most competent and thoroughly posted men in telephony, and I had confidently expected that he would be here himself to read a paper which would give you information and valuable instruction; but, unavoidably, circumstances or conditions prevented, and less than a week ago he was compelled to decline the duty. Our president then telegraphed me, requesting that I occupy the position of "stop gap."

It is most unfortunate for you and, somewhat so at least, to myself, for aside from inability to treat the topic with the command and technical knowledge it should have, when presented before such a body as this, I have been too busy to use even what little ability I may have properly, and the time has been too short to suitably formulate the few stray ideas which have come to me upon this important subject. The truth is that my experience as a president or a director of a telephone company has been more upon the side of finance or promotion, and my knowledge of operation is from consultation rather than actual experience, so that you see my expression "stop gap" is only too correct, and I can hope to be able to do little more than present a few salient thoughts which come to the layman, as a text for the discussion which may follow, and, being brief, will permit more lengthy discussion.

The general proposition may be assumed that the greater always includes the lesser, and that a discussion of this topic from the standpoint of a larger plant will furnish the required suggestions for smaller service. Upon that theory, we will start with the idea that owners or directors of a given plant or system have selected as their representative an intermediary and officer, who might be termed the general manager. He is their exponent. He has the general policy of the company; as to them, he is the organized force which is to give concrete expression to their abstract wishes. They approach him only for carrying out their plans, and he is the sole authority for the general direction of their business. He must have a staff of lieutenants, if you please, who will, under his directions, see that the plans which he provided are carefully developed.

Had I the faculty and apparatus, I think I would draw a diagram illustrating this main thought, and upon the large scroll on the left side place the word general manager; on the right I would place, as his chief lieutenants, traffic manager, auditor, supply and repair department, superintendent of construction, engineering department, territorial department, and, possibly, a seventh department might be named as the contract department, for, to judge from some of the reports we see in the newspapers as to work our competitors are doing in Wisconsin, Michigan and other states, that seems now to be a requisite. I deem it true that the first requisite in such a business is thorough organization. After that has been secured, discipline can follow, and should.

In such an organization, at least as far as the public is concerned, the most important lieutenant is the traffic manager. He is the man whose immediate subordinates and their assistants come into contact with the patrons of the exchange, upon whose technical and business ability and courtesy depend in very large degree the success of the system. He must be a very good judge of human nature, competent in the selection of employes, and also when brought into contact with patrons of the exchange. As his immediate subordinates should be named the chief operator in the day system, chief operator for night duties, the switchboard inspectors and wire chief. To this list might be added, perhaps, the chief toll operator and the monitor.

I have not the time, nor you, to follow in detail the special duties of each one of these employes. I can only hint or suggest them, and leave to your individual observation or experience the elaboration of such hints or suggestions.

The chief toll operator should be thoroughly conversant with the entire toll system reached by the exchange, the points or exchanges, of their perfection or effectiveness, and should be able to answer any query of subordinate operators upon this branch or as to rates of service. Each one of these operators should be held to a "civil-service examination" and rules for this department, to the end that they may know, without apparent thought, how to reach the subscribers or points desired, which way is best, which is the second or next choice if the best way is in use, and what is the expense. This must be learned or memorized, so that the answer may be immediate, and the service desired rendered at once.

One might say that the operators proper are next in consideration. As to their qualities and duties, no dissertation is necessary. We, from the managing side, and the public, from the patronage side, are in sufficient contact with them to have numerous ideas as to what they should and should not do, and we may dismiss the operators with this thought. The chief operators, under the supervision of the traffic manager, should be very carefully selected, and should have all the minutiæ of the system thoroughly at hand. They should know when their subordinates are doing their duty, when the apparatus is in perfect condition, what the public is wanting, and whether it is getting what it wants. Much might be said upon this—your own experience will follow the thoughts that will come upon the mere mention of the general duties. In this department the record clerks are employed, and their work is of vital moment. Had we the time, I should be very glad to take up each one of the blank forms used in the exchange with which I am more closely connected, and discuss the reason for their use and their utilities.

Thanks to our traffic manager, who is one of the most competent, as we believe, in the country, I have brought with me specimens, and shall be glad personally to exhibit them at convenient opportunity to anyone who may have special interest in the topic. We are of the opinion that these records must be perfect in their information as to lines, insulation, instruments and the conditions of any case of trouble that may arise. We require ample reports, and have a system of combining these reports and the records that enables the traffic manager or his chief operators to secure or to give complete information at a moment's notice.

It may just be hinted that the traffic manager and the chief operator must be thoroughly familiar with the isothermal-service lines or special-stress periods of the system when serving a thousand or more telephones. Without this knowledge, it would be impossible to wisely regulate the number of extra operators or substitutes required, or to plan the time programme of the work so that operators may be furnished when the public must have them, and, at the same time, so that these employes may secure time for rest and meals, as all humans require. A mere suggestion in this direction will carry the thought from your own observation to such further requirements as are peculiar to your own plants.

The monitors, in an exchange of 2,000 telephones, can earn their monthly salary almost every week in the conservation of material—in the savings of the cords alone, if you please—as well as in their other duties. Your own observation will follow this thought.

The imperative necessity of having competent assistants "back of the boards" needs no lengthy discussion. The switchboard inspection is a department with which, even in small exchanges, most of us are familiar. The wire chief will have in his general charge the department external to the central office, the insulation of inside wires and setting of instruments, the trouble on lines and the repairs or maintenance of toll lines near by. Of course, the traffic manager is watching each one of these departments, and can only secure the best results when personal supervision has taught his subordinates that he is watching all their work.

As to each one of these duties, a more lengthy paper than I am permitted to present as a whole might well be written and read, to your profit and advantage, but that is not the province of such a convention as this or of such a paper. It is only to hint a broad reference to good organization and to leave to each of you such details as may be available for your individual cases.

As to the auditor's department, it is not necessary to give details. The force of bookkeepers, the cashier, the subordinates who take care of the directory, the rate clerks, the people who meet the public, are all performing duties which differ little from the average or ordinary employments, and good business sense will cover these particulars, as in any business.

The next department is more especially under the watchful eye of the general manager—the supply and repair department. The stock room and the repairs of instruments and cords, etc., will be in the care of a chief who reports to and takes direct orders from the manager. Here the manager acts more directly, perhaps, than in almost any other department of the system, making a selection of material required, ordering its purchase and controlling its distribution. Thorough systems and records in this department as to reception and disbursement of material, repair of apparatus, etc., will prove profitable in the extreme, and will increase the efficiency of the business to a degree not realized until it has been tried.

I may use next in order, though not next in proper sequence of importance, the superintendent of construction. He has charge of the external work of the plant, and under him are the foreman and the various gangs of outside employes, whether they are building aerial lines or putting in conduits, or taking care of terminals—whatever their duty. This department has been more especially treated in theory in another paper, and needs only to be alluded to in this connection. We in the independent field have found that the construction department has very extensive and continuous duties; hence, in discussing operation and maintenance we must allude to it, if not more.

Next the traffic manager, scarcely secondary to the general manager in importance, is the engineering department of the telephone system.

The average layman, indeed, the average employe of a telephone system, whether independent or Bell, has but little conception of the intricacies and possibilities of this department.

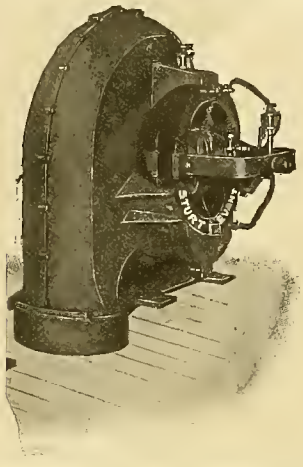
It would scarcely be expected that a "stop gap" like myself should elaborate this phase of operation and maintenance. I can only generalize and suggest. It is my opinion that the independents have

1. Read before the Independent Telephone association, Chicago, June 27, 1899.

not given this department the value it deserves or that is necessary to their highest success and greatest profit. It is only within a comparatively short time that many of the subordinates of the Bell company have given this department of the work any considerable consideration. It has been exceedingly useful to them and it would be vastly more useful to us, because we have not access to the experience of the entire field, as the licensees of the American Bell have had heretofore, as guides to wise action or the best methods.

The engineering department decides what methods are best, tests material for the use of the construction department or apparatus for installation, and ascertains whether such material or apparatus complies with specifications, or will perform the duties required.

Right at this point, permit a suggestion which, perhaps, is foreign to the topic and might have more



STURTEVANT ELECTRIC EXHAUST FAN.

direct place in the topic of construction, but, as I have hinted, I consider the engineering department of almost overshadowing importance. I believe it would be a good thing for this association to assist its membership and the independent interests generally with the very best skill that can be commanded in this field, employing one, two or even three experts, if necessary, who shall be employed not only for testing supplies proposed, but in making specifications as to that which is requisite to accomplish the results we all know must be attained. There is a field here at which I am merely alluding, that should be carefully considered and discussed. If an exchange feels that it has not, because of its size or lack of size, the means with which to employ the best talent in any particular case, it should be able to get assistance and know where to find it; and what better medium than such an association as this, of which that exchange is or should be a member. With such a department there would be additional reason for the payment of annual dues to this association, even though larger sums were exacted than are now proposed.

Not many of us are yet seriously burdened with those questions which we are likely to meet in the near future as to interchange of business and the extension of toll-line systems. If the independent systems are to render service equal to public requirements, this department will soon grow in importance and value beyond even the most rosy anticipations of most of us.

In the exchange with which I am more naturally familiar our toll service has more than doubled within the past six months, and is still growing at a ratio that almost overwhelms us. We think that with cheaper rates for such service than have been charged heretofore, the popularity of the telephone as a means of communication will increase beyond the wildest dreams of those familiar with this department four or five years ago. This fact is true with the Bell company, as well as ourselves, and but suggests what we must prepare for. We must be wise in the establishment of rates; we must have our "clearing houses" at convenient points in our respective territories, through which rapid and efficient interchange of business may be accomplished, and we must provide for methods of operation and of maintenance on toll lines not heretofore developed by any independent system in this country. In this field the old company is still learning many lessons, with all of its experience. How much more important that we begin at once to give it the requisite consideration.

There is but one more thought that I wish at this juncture to emphasize. As I have before intimated, and as is apparent from the organization I have indicated, this is for a larger system than most independent companies are yet working, and is founded somewhat upon the experience and observation connected with the system with which I am more immediately connected. Of course, a small plant would have less elaboration, and you can subtract from this such departments as will not be needed, although the various duties here suggested would have to be cared for in any plant, but your traffic manager might well be termed the "whole thing" in his department, aside from the operators, and your general manager may be the rest.

But I must hasten. There is one other thought, perhaps the most difficult and delicate I have approached. It may be that this ought not to be broached in a paper on "Operation and Maintenance," and yet I know not where else it should be included, if not in this. It goes to the root of our business. We know of exchanges of 100 or 200 telephones that are undoubtedly being successfully operated in their communities at very low figures of cost. It has been believed by those not well informed that larger systems ought to be, and can be, operated at similar cost. It is true in the telephone business, as it is not true in most other business, that the larger the business the greater the expense pro rata and per capita for operation and maintenance, as well as for construction; where, in a plant of 1,000 telephones, a rate of, say, $20 to $30 may be fairly successful, in doubling the plant, it will materially increase cost of building and compel a still greater increase per telephone in operating.

I am of the opinion that we need, as well as the public, more information than we have yet secured in this branch, in accepting franchises or ordinances, in the larger cities of the country which are now being developed. We should not be so eager to try to secure them as to entail perhaps a serious burden upon the future of the business in the smallness of the maximum of prices permitted to be charged.

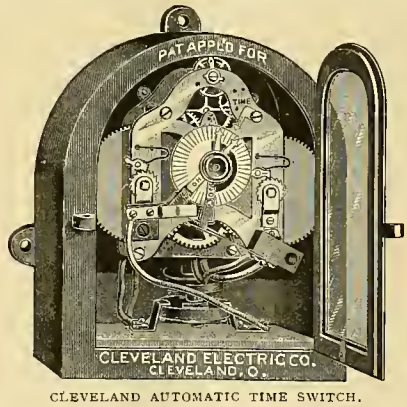
We all know that the old company has exacted an undue profit; at the same time, it would be most unfortunate if the independents should establish a scale of rates for service that would not permit first-class service and a reasonable return upon the investment required for such service. I sincerely hope that any discussion which may follow this paper will consider fully this part of the topic.

Thanking you for your patience and forbearance, and again expressing regret that the gentleman to whom this topic was first assigned was unable to be with us and give us of his ripe experience and large observation, I close with hope that we shall so operate our plants as to compel their patrons to continue the service and also maintain an increasingly higher standard of usefulness to the public.

Discussion.

Mr. De Land: I would like to ask if it would not be a good idea to have a committee prepare what might be called "Specifications for Franchises," to be used by the association. It seems to me that if there was a committee of that character to prepare what might be called a model franchise, we might be able to do away with the limitation clauses. In doing work down in Pennsylvania and West Virginia, we have found that a great many companies have been "frightened into accepting such a franchise." They had to take that or get nothing. They have had clauses in their franchises limiting the rates to $12 or $15, and in one case as low as $9.

The independent people have brought the telephone business to the condition it is in to-day. As one gentleman has said, "there are 10 telephones in use to-day, where two years ago there was only one; and in the next five years there will probably be 40 to where there is one to-day." In every city that we have gone into and every town the people there have told us: "You have given us good service, and we will stand by you. We will take your franchise and cancel it and give you a new franchise and remove the limitation clause." It seems to me if the association would take that question up, that in a very short time all our franchises would be granted without the limitation clause, and then we could give service far superior to anything that we now have, throw away our present equipment, put



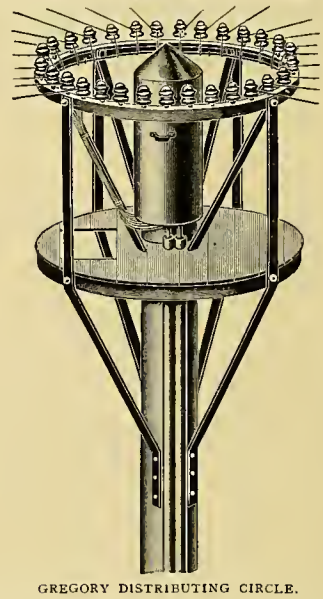
CLEVELAND AUTOMATIC TIME SWITCH.

in improved equipment, and, if necessary, charge, say, 25 to 30 per cent. higher rates than we are getting at the present time. If you can get $24 to $36, where you have 100 to 500 subscribers, your price will be low, if you build good lines.

Mr. Hogue: I don't object to a uniform franchise, but I think the best way to solve that problem would be to start a college to educate the councilmen. You find that in every town where you attempt to get a franchise the council has different ideas, and it is almost impossible to talk those ideas out of their heads. I think, however, there is a great tendency on the part of promoters, who have not had any telephone experience, to go into a town and apply for a franchise, and base the rates at $9, $10 or $12 per year. A great many people have an idea that a franchise is wonderfully valuable; that all you have got to do is to get a franchise in your pocket, and you have something that you can sell for from $10,000 to $150,000. My experience with franchises has been that they amount to nothing until you invest a large amount of money in developing them.

Mr. Fisher: I found in visiting places in the Middle West that a great many people imagine that because a company wth 250 or 300 or 400 telephones was prosperous at rates that are common in plants of that size, it was possible to operate a plant in a city like Grand Rapids or Detroit or Cleveland at the same figure. People say it is like any other business. You can do it by wholesale cheaper.

Now, I simply want, in this connection, to sound a note of warning, and have each one of you say to your neighbors and friends, that they must be careful in that direction: that they must not get



GREGORY DISTRIBUTING CIRCLE.

the impression because they are operating plants in towns of 5,000 or 6,000 successfully, at a given rate, that they can come to a town of 40,000 or 50,000 and operate at a greater profit because of the large number of possible patrons. There is too much vagueness and lack of information in that direction. My experience in Ohio and in Michigan has led me to say what I have this afternoon.

You who are interested in the smaller plants and desire service in larger cities would help your neighbors and friends in the larger cities by making that fact clear to them. You will frequently be called upon by officials and others connected with the larger cities for statements as to what rates you are getting, and perhaps what profits you are making, and because they are not fully informed upon that very branch of the subject, they go home with the idea that they must establish certain limitations for the benefit of their people in the franchises they grant, or no franchise will be granted.

Now, we have to live and let live in this field, and we must not get our rates so low as to prevent our giving just as good service as anybody in the world can give.

Gregory Distributing Circle.

The contrivance illustrated herewith is manufactured by the Therien Tool Works, 116 First avenue North, Minneapolis, Minn., and is designed as an improvement in line construction. It is planned to give a better arrangement of wire attachments for aerial distribution, on a pole top, than the usual cross-arm construction. It is light and strong, easy to adjust, and by the use of brackets below the circle a 40-wire ring may be doubled in capacity. It is made in several sizes, and it is said that 150 are in use in Minneapolis and St. Paul.

Cleveland Automatic Time Switch.

The value of a reliable switch for turning on and off lights at predetermined times, particularly for use on street-lamp posts, worked from constant-potential circuits carrying commercial loads, is self-evident. The need of an automatic switch has been particularly felt by those who have used electrical signs and electrical displays in show-windows.

A new switch of this type is that shown in the accompanying illustration and made by the Cleveland Electric company, Cleveland, O. It consists primarily of an eight-day Seth Thomas clock, fitted with a 24-hour stem on which is centered a time dial and two independent pointers. The contact of one of these with an appropriate piece closes the circuit through a solenoid, which operates the switch, the movement of its armature immediately breaking the circuit with the pointer by moving the piece with which it makes contact. The same motion places in position the appropriate contact for the other pointer, which in turn is removed and the circuit broken as soon as the reverse operation of the main switch is made.

The switch is designed to withstand climatic changes, and in this respect it has given especial satisfaction. The switch has been especially welcomed by lighting companies operating on a flat rate,

as it is designed to regulate the amount of current used. One operation of the switch is all that is required to accomplish its purpose, as the same motion turns the current on and off. The energizing of the magnet attracts the armature and the switch is thereby operated and the current immediately cut out of the magnet. The disks and all insulated parts of the switch are made of porcelain and every switch is able to carry a definite load. Each switch is designed especially for the work designated. The device can be used on alternating or direct current.

Sturtevant Electric Exhaust Fan.

In the illustration on page 40 is shown one of the Sturtevant Monogram type electric fans. The shell of the fan is of cast-iron, exactly similar in proportions and form to that used in the regular Monogram blowers and exhausters. This fan is arranged as an exhauster, to discharge directly downward, having the side to which the motor is attached entirely closed, so that air and dust will be drawn across the motor.

The field ring of the motor is of wrought-iron, and is bolted directly against lugs which project from the side of the fan. The poles are two in number, also of wrought-iron, and carry the field windings, as shown. The armature is of the drum-wound type, and the shaft carrying the same is supported in ring-oiler bearings, suspended in yokes projecting from either side of the field ring. To avoid any trouble from oil, it is dripped directly into a tank attached to the under side of the field ring.

The entire arrangement is compact and stable, and it is susceptible of support in any desired position. In small sizes it is sufficiently portable to be used for temporary location, as, for instance, in different parts of the hold of a ship. Plants of this type are usually built to operate at pressures of from one ounce to five ounces per square inch. The B. F. Sturtevant company of Boston, Mass., is the manufacturer.

Electricity to Be the Main Feature of the Pan-American Exposition.

At the Pan-American Exposition in Buffalo in 1901 there will be about 10 main buildings. Mr. Edwin Fleming, the secretary of the Board of Managers, says that the main building will be devoted to electrical apparatus. The exposition authorities hope to make the greatest display of electrical apparatus ever made. It will be especially appropriate, owing to the remarkable development of electrical power at Niagara Falls. The engineers will use the Falls electrical power to propel all the machinery used in the exposition buildings and will light all the buildings with electricity from the same source.

How Electricity Kills Animals.

In the sessions of the Society of Physics and Natural History of Geneva on March 2d Professor Prévost and Dr. Batelli presented a report of experiments made to determine the mechanism (mechanics) of death by electricity. They say that all animals subjected to currents of high tension—2,500 volts, for instance—die from their effects upon the nervous system, and chiefly by the arrest of respiration. But the heart continues to beat; its contractions are strong. The animal may then be saved by applying artificial respiration. If a low-tension current is employed—say 40 volts—the phenomena are different. The nervous system is but slightly affected and the animal continues to breathe, but the heart ceases to beat. Its movements are irregular and it does not force the blood into the vessels. The heart of the dog and of the Indian pig never recovers its action; these animals die of paralysis of the heart; they fade away without sign of pain. No method of restoring them has been discovered. Rabbits and rats, however, do not die under a weak current; their hearts, stopped for a moment, resume their beats when the current is taken off, and they seem to be as well as before the experiment. The most curious result obtained is that the pulsation of the heart of a dog, stopped by a low-tension current, can be re-established by passing a high-tension current through the animal. The paralyzed heart resumes its pulsations and the animal may be revived by artificial respiration.

New Motors and Motor Auxiliaries of the Crocker-Wheeler Company.

Dynamos and motors were made at first in the ordinary or open forms and in very high speeds. Afterward others of medium speeds and very low speeds for direct connection were placed on the market, and now motors of still other types having characteristics just described are being manufactured. The Crocker-Wheeler company of New York has given some attention to the designing of these special types. This follows the success of the company as a pioneer in the application of motors to machinery. For places requiring motors capable of exerting great starting torque and ready reversal and protection from foreign substances which may be in the air, it makes an enclosed motor to which it has given the term "mill" motor, as this type was first used for hoists, etc., in rolling mills.

Fig. 3. Brake Mechanism of One-way Brake Motor.

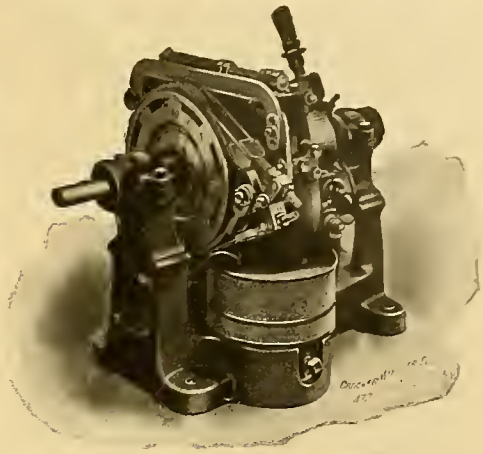


Fig. 4. Motor Equipped with Reversing Brake.

NEW MOTORS AND MOTOR AUXILIARIES OF THE CROCKER-WHEELER COMPANY.

The mill motors consist of an ironclad armature encased on all sides in a cast-steel box nearly the shape of a round-edged cube. A motor of this type with a solenoid brake is illustrated in Fig. 1. This box form serves as a complete cover for all the working parts of the machine, excludes the outer air and prevents the admission or escape of sparks. As this construction prevents ventilation, it precludes the use of this type for continuous running at full load, on account of heating. Since the enclosing metal serves at the same time as a field frame and prevents external magnetic leakage, these motors may be properly called "ironclad." As shown in Fig. 1, the connecting wires are brought from the inside through insulating bushings. The box is provided with feet and with other projections to form the casing for a pair of gears and the supports for countershaft journals when back gearing is desired. A modified form of this mill motor is suitable for use as railway or car motors. The construction of the armature cores is of the slotted pattern. The core and commutator are mounted directly on the shaft without the intervention of a support. The winding of these machines is of the drum form and is connected for two circuits. The frames have inwardly projecting poles and are divided horizontally through the axis of the armature into two parts. Three sizes of these machines are made. Of these sizes two have four poles and one has two poles. These poles are split by the division of the frame, and are, therefore, not provided with coils, but are made consequent poles, the fields being energized by the coils which surround the other poles that are above and below the armature. Rigid bearings are used, as they are stronger for the heavy work which they perform.

Since these machines are used chiefly in work which requires that they be frequently reversed, the brushes are not designed to have a lead. The holders are fixed permanently in a central position, and the fields of the machine are made strong enough to enable them to run in either direction without sparking. The holders are of Crocker-Wheeler hammer, radial type, and the current is conveyed to the brushes by the flexible copper braids attached to brass plates screwed to the tops of the carbons. This avoids the passage of the current through any sliding contact.

In their operation machines of this type differ essentially from belt-type machines, in that when they are slowed down or started from a state of rest they are capable of exerting a turning power many times greater than that given at full speed. Their efficiency is a little lower than that of the belt type, because they are designed to have certain other characteristics in a marked degree by its sacrifice. That obtained at starting and at low speeds is smaller because the losses are nearly as great as at any time, while comparatively little power is developed, although they are making a great starting effort. At middle speeds the efficiency is the highest.

The Crocker-Wheeler elevator motors are made in two sizes. This motor is of the self-starting type and combines the features of toughness and adaptability for constant reversal found in the mill motors. An extra long frame is provided for the purpose of starting the coils, as shown in Fig. 2. As elevator work is extremely severe for the motor and for the electric lights in a building on account of the constant starting, stopping and reversal, under full and partial loads, some of the features of the mill motors applied to elevator motors are particularly applicable. The starting coils are graduated so that the first takes a very little current, the next a little more, and so on, while all contribute to the working

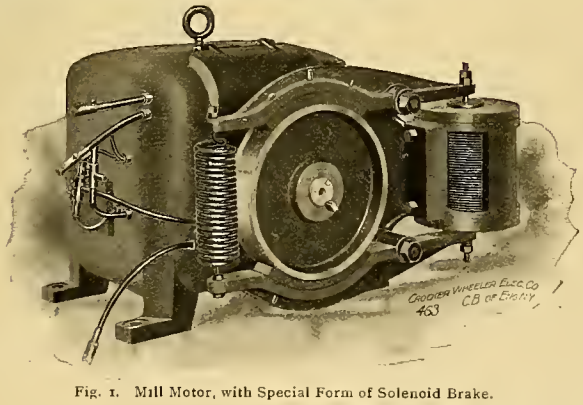


Fig. 1. Mill Motor, with Special Form of Solenoid Brake.

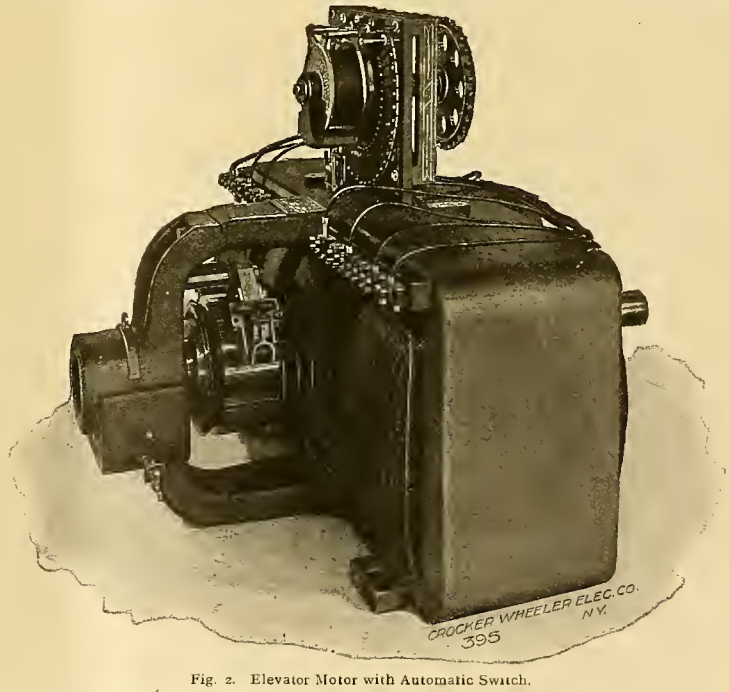


Fig. 2. Elevator Motor with Automatic Switch.

NEW MOTORS AND MOTOR AUXILIARIES OF THE CROCKER-WHEELER COMPANY.

strength of the motor. These coils, when properly calculated for the load, enable the motor to be started and brought evenly and quickly to full speed by the use of a steadily moving switch, without at any time drawing more current than that used when running at full speed. This avoidance of a sudden inrush of current at starting saves any lamps which may be connected to the circuit nearby from fluctuation and is a feature of this type of elevator motors.

In construction the field is of cast-steel, rectangular in shape and in cross-section, and has two salient poles and two consequent poles. The salient poles are placed at the sides, in order to allow the shaft to be brought close to the floor for direct-connection. Five series coils are used in the gradual starting of the machine. A modification of this type for plain factory, requiring a tough, durable and inexpensive motor, is made under the term of shop motor. This is smaller in appearance than the elevator motor and differs only in mechanical details.

The new Crocker-Wheeler brake motors are of the bipolar construction, the brake action being obtained by means of a pivoted field and strap. These machines are designed to fulfill a demand for use where an accurate, powerful and sure stopping of machinery is required. As motors are often used for hoists and in driving machinery which, like printing-presses, has to be stopped with precision, some device for braking the motor becomes necessary. This is supplied in the Crocker-Wheeler one-way and reversing brake motors, illustrated in Figs. 3 and 4. It is essential that the brake be applied automatically to be simultaneous in action with the stopping of the power, because if not put on until after the motor is stopped the load which was to be hoisted would descend, or the press would run too far, and if applied too soon would strain itself by working against the brake. Hand or foot brakes and others which are separate or independent in their action require great care in their operation. The tightening force is a spring, which is restrained as long as the operating current is present in the solenoid or other magnet connected to the motor winding. The Crocker-Wheeler company uses part of the regular working current of the machine for operating the brake at the same time it energizes the motor fields, and has produced a machine which is in itself both a motor and a grip. It also makes a solenoid brake for the belt-type machines, the fields of which cannot be pivoted. A form of this brake applied to the mill motor is shown in Fig. 1.

The operation of these brake motors is very satisfactory. The brake may be adjusted to bring the machine to a full stop within any space of time, the rate of absorption of energy depending upon the suddenness of the stop. For instance, a size 10 machine, running at normal speed, can be stopped in three seconds. In this time it would make about 30 revolutions. The rate should be set so as to hold the full load of the motor; that is, a load that would require 10 horse power to hoist. If it is desired to stop the motor in a shorter time than this, the energy absorbed by the brake would be correspondingly greater than the full power of the machine. The uses of machines of this type are very numerous, especially for cranes, elevators and hoists, where it is important to hold the load after it is lifted, also for looms, printing-presses and other classes of machinery where it is important to obtain a sudden, accurate stop at a given place, instead of a gradual slowing down.

The Chicago offices of the Crocker-Wheeler company are at 1514 Old Colony building.

CORRESPONDENCE.

New York Notes.

New York, July 10.—Henry Payne Whitney, the president of the New York Electric Vehicle Transportation company, is a director of the American Air Power company, and it is said that negotiations are well under way for a consolidation of all the compressed-air companies, the American Air Power company to be the parent company. That company will be closely allied to the Electric Storage Battery company and the electric-carriage interests through the Whitney group of financiers. The operation of the air-power cars in Twenty-third street having met all the requirements of the Metropolitan Street Railway company, it is said, that corporation has decided to equip with compressed-air motors all its other crosstown lines, and also the Belt line, and will also have in operation next winter on its cable and underground trolley roads a large number of compressed-air snow-sweepers. Air power will be substituted for horses on the Twenty-eighth street and Twenty-ninth street line, it is said.

A connection between the old Brighton Beach railroad and the Long Island railroad tracks near Coney Island, which will enable the Brooklyn Rapid Transit company to run its cars into the terminus at Manhattan Beach, is being laid, and within 15 days it is expected that trains will be operated by electricity over the Kings County elevated tracks from the bridge and over the old Brighton road to Manhattan by way of the new switch.

The temporary injunction recently obtained by Joseph Blank, a taxpayer, to restrain Commissioner Henry S. Kearny of the Department of Public Buildings, Lighting and Supplies from making a contract for lighting the streets and public buildings of New York, was continued by Supreme Court Justice Maddox in Brooklyn on Friday, pending the trial of the action in October. Mr. Blank contended that Commissioner Kearny had no authority to let the contracts, as they had not been approved by the Municipal Assembly.

Electric cars were run regularly over the Fifth avenue branch of the Brooklyn elevated railroad last week for the first time, and the third-rail system is declared a success. When the line is equipped to Coney Island and through service is put in the steam trains will be gradually discontinued, until nothing but electric trains will run. Last week's trial was awaited with some anxiety, because when the first trip was made several days before the motor-car ripped up the outside guard rail on the track.

The transfer of the Kings County Elevated Railway company to the Brooklyn Rapid Transit company was practically accomplished last Thursday, and the latter is now at liberty to go ahead with its plans.

The employes of the Metropolitan Street Railway company consider that they have grievances in the matter of the number of trips required for a day's work, but it is probable that the difficulty will be settled by conference without a strike. M. S.

PERSONAL.

W. H. Wissing has been appointed general agent at 642 Century building, St. Louis, for Nangle, Holcomb & Co. of Chicago.

At the annual meeting of the British Association for the Advancement of Science, in Dover, on September 18th, Professor Fleming will deliver an address on the "Centenary of the Electric Current."

The death of H. S. Willard, superintendent of the Nanticoke (Pa.) Electric Light company, occurred at the City Hospital in Wilkesbarre on June 29th. He had been ill with typhoid fever a little over two weeks. He was 26 years old and unmarried.

Mr. Fred H. Fitch, having become financially interested in the Electrical Installation company of Chicago, was, at a special meeting of the stockholders, held June 17th, elected a director, and at a subsequent meeting of the directors elected vice-president of the company.

Brigadier-general Irving Hale of Denver will soon retire from the service and return to the United States from the Philippines. General Hale, who is a well-known electrical man, is a graduate of West Point. He has made a brilliant record in the Philippine campaign and his friends are proud of him.

John E. Powell, who for the last 13 years has been inspector of electric-lighting plants in United States public buildings under the control of the Treasury Department, has been promoted to chief mechanical and electrical engineer in the office of the supervising architect of the Treasury Department. The promotion is a well-earned one.

Colonel Charles A. Munson, the popular manager of the Chicago office of the Fort Wayne Electric Works, was a passenger on the French liner La Champagne, that sailed from New York on July 8th for Havre. Colonel Munson will spend the summer in France, Germany and Switzerland, sailing from Havre on the return trip on September 16th. His holiday is well earned and his friends hope that he will thoroughly enjoy it.

L. C. Van Liew, an assistant in the office of Rae & Monroe, the Chicago electrical and mechanical engineers, died last week under peculiarly distressing circumstances. Mr. Van Liew delighted in original investigation, and while making some observations at the plant of the Hinsdale (Ill.) Electric Light company on July 2d he slipped and fell into the hot-well. He was quickly rescued, and while he was badly scalded, it was not thought that his injuries would prove fatal. On July 4th Mr. Van Liew suffered a relapse, however, and died very suddenly. He was about 28 years of age and leaves a wife and two small children, who are thus, almost without warning, deprived of their means of support.

Charles T. Yerkes bade good-bye to the employes of the North and West Chicago Street Railroad companies on Saturday last. Mr. Yerkes has resigned the presidency of those companies and will assume immediately the active management of the Chicago Consolidated Traction company and the Lake Street and Northwestern Elevated Railway companies. He will remain in Chicago, with offices in the Royal Insurance building, and devote his time to the interests of these three properties. Mr. Yerkes has been a street-railway man of prominence for a generation and first became interested in the North Chicago system in 1886, his previous experience in the business having been in Philadelphia. He is a man of great force of character, but his administration has not been popular with the traveling public on the North and West Sides.

ELECTRIC LIGHTING.

The village of Greenup, Ill., will receive bids, up to July 25th, for a complete electric-light plant. Plans and specifications may be seen at the office of W. H. Cunningham, village clerk, Greenup, Ill.

A Racine, Wis., dispatch states that Matthew Slusch, A. W. Bishop and other officers of the Milwaukee, Racine and Kenosha Electric Railway company have an option for six months on land at Matanzas, Cuba, upon which, if it is purchased by them, will be erected a large electric-lighting plant and warehouse large enough to hold the produce of the surrounding country, while a system of electric railways will be built from Matanzas to the neighboring towns. It is the intention to begin work inside of four weeks.

The Minneapolis Tribune gives this description of a large sign erected by a clothing concern in that city: "The words 'The Plymouth,' in letters of wood three feet square and a foot thick are strung, one above the other, on perpendicular iron pipes. These pipes act as conduits for the electric wires that run to the letters and light up the 346 incandescent lights studded in their white surfaces. A switch in the store turns on these lights every night. The sign weighs 5,000 pounds. A large bolt runs through the wall of the sixth story, and attached to this are the two heavy hangers that hold the sign suspended. Four large double braces, spread at angles of 45 degrees, to prevent the wind disturbing the position of the sign, are located one between each of the five stories covered by the sign, and these braces are held in place by strong plates attached to the wall. The ironwork of the sign, with the exception of the braces, has been covered with bronze, and the braces have been painted the color of the yellow brick of the wall. The letters of the sign are enameled a snow white, with trimmings of old gold."

ELECTRIC RAILWAYS.

It is said that work on the projected electric railway to connect Little Falls and Herkimer, N. Y., will be begun at once.

Work is under way for an electric railway from Lewistown to Burnham, Manns and Reedsville, Pa. The Lewistown and Reedsville Electric Railway company is building the line, for which the Tennis Construction company of Philadelphia has the contract. J. I. Quigley of Lewistown, Pa., is president of the new electric-railway company.

A new traction company was formed in Allegheny, Pa., recently for the construction of an electric line from Etna to DeHaven, a distance of about five miles. The company will be known as the Pittsburg and Butler Traction company, and the officers will be: President, Henry Wittmer; vice-president, Xavier Wittmer; secretary, Frank McMillan; treasurer, Frank B. Morran.

The Chicago and Milwaukee Electric Railroad company has opened its road from Highland Park to Winnetka, Ill. The road will be complete from Waukegan to Evanston, with the exception of two blocks in Kenilworth, by July 20th. The Kenilworth authorities still refuse to grant an ordinance to the company through their town east of the Northwestern railroad tracks.

Regular service on the Needham and Boston street railway was inaugurated on June 29th, the final trial trips having been made on the previous day by a special party. A collation and reception to President Hicks of the company were given by the citizens of Needham after the trip. Three lines now have their terminals in Needham, and a fourth is projected to run via the towns of Charles River and Dover, Mass., to Natick from Needham.

A certificate of incorporation of the Warren County railroad has been filed. The company will build an electric freight and passenger road from Warrensburg, N. Y., to Lake George, a distance of seven miles. The principal stockholders are ex-State Treasurer A. B. Colvin and J. M. Coolidge of Glens Falls, J. A. Powers of Lansingburg and Congressman L. W. Emerson of Warrensburg. The capital stock is $200,000. It is understood that in time the road will be extended from Lake George to Glens Falls, a distance of 10 miles, thus making a system 22 miles long, extending from Warrensburg to Fort Edward.

AUTOMOBILES.

The New England Electric Vehicle Transportation company has made a beginning in its automobile business by putting five carriages in service in Boston. Thirty more are expected within a month.

Mr. Arthur Lewis of Boston, lately returned from Europe, says that the solid-rubber tire for automobiles is in great favor in Paris. He thinks that eventually the solid-rubber tire will be used exclusively for horseless carriages.

Manitowoc, Wis., will probably have an automobile-stage line, the Manitowoc Traction company having been organized for the purpose. It is said that the company has placed an order for four automobile passenger coaches. Two will be used for transportation of passengers about the town, one will be run between Manitowoc and Two Rivers, and the fourth will run between English and Silver Lakes and Manitowoc.

At its last meeting the Chicago City Council refused to pass the Auto-stage company's ordinance

for permission to operate a line of automobiles. Alderman Hermann opposed the motion to suspend the rules on the ground that the language of the ordinance was ambiguous enough to permit new street-car lines to be established. The vote to suspend the rules was lost—ayes 31, nays 32. The ordinance was sent back to the committee on licenses.

The Stanley Locomobile company has purchased what is known as the Kingsland property in North Tarrytown, N. Y., for a factory for the manufacture of automobiles. The tract consists of 225 acres, with a manor house, and has a mile of river frontage on the Tappan Zee. The price is said to have been $185,000. Amzi L. Barber of Ardsley, N. Y., is president of the company, and John Brisben Walker of Irvington, N. Y., editor of the Cosmopolitan, is vice-president. It is asserted that $100,000 will be spent in getting the factory in operation.

An occasional accident shows that the Chicago idea of licensing automobile operators, after examination, has wisdom in it. William K. Vanderbilt, Jr., has been recently experimenting with a rented electric carriage at Newport, and he came to grief on July 4th. It seems that, on Beacon Hill, he started to back the vehicle down the incline. Going downward a short distance, he came to a stop, and then, forgetting to remove his foot on the reverse lever, applied the power to go ahead. With both switches open at the same time the result was that the machine simply turned over, making a number of complete somersaults on its way down the hill. On its first turn it landed squarely on top of Mr. Vanderbilt, but so great was its momentum that it did not stop but went onward in its career to the bottom of the hill. Mr. Vanderbilt was not seriously injured, but the machine did not escape so easily. The motor and battery cells were broken, the starting lever bent double and the upholstery torn, the damage being estimated at not less than $700. Mr. Vanderbilt is not, it is understood, discouraged by the accident. He will have repairs made to the vehicle, of which he has a rental for the entire season, and try again.

TECHNICAL SCHOOLS.

A programme of graduate study in electrical engineering, at the University of Wisconsin, for the next college year, has been arranged. Professors D. C. Jackson and B. V. Swenson and Messrs. C. F. Burgess and M. C. Beebe are the instructors. The registrar of the university or Professor Jackson can give information.

The University of Notre Dame, Ind., is a large and well-established institution of learning that has lately devoted much attention to applied electricity. This department is in charge of Professor J. J. Green, who is a young and enthusiastic investigator, and whose successful experiments with Marconi apparatus have attracted much attention.

The Year Book of the Armour Institute of Technology of Chicago gives all needful information about the school, with announcements for 1899-1900. The Technical College provides courses in mechanical engineering, electrical engineering, architecture, science and civil engineering. Charles Volney Kerr is professor of mechanical engineering and Irwin John Macomber is professor of electrical engineering. The laboratory of this school is particularly rich and well equipped.

PUBLICATIONS.

The Western Electric company has distributed copies of its bulletin No. 7002, descriptive of the arc lamps of its manufacture. If any of the readers of this journal have not received a copy, this bulletin will be mailed to them upon request.

Gates & Randolph, the electrical contractors of 13 and 15 Monadnock building, Chicago, have issued an attractive illustrated circular which shows, in a striking manner, their extensive connections in the field of electrical machinery. They have direct-current machines, alternators, electrical instruments, arc lamps and switches and switchboards.

The handsome new catalogue of A. L. Ide & Sons of Springfield, Ill., is divided into three parts. Part I. treats of the well-known Ideal simple and compound engines, showing, with full illustration, the various types of engines made, with statistical information and data of performance. Part II., devoted to "Special Equipments and Devices," shows valves, steam separators, power transmitters, belt tighteners and the like. Part III. gives the "Details of Construction"—lubrication, drainage, governor and so on. The catalogue is a valuable work of reference and its mechanical execution is excellent.

A very attractive booklet on the subject of "Trolley Trips" in and near New England has been made by Katharine M. Abbott of Lowell, Mass. The little work is thorough in detail and information, dainty in execution and thoroughly sympathetic in pointing the way to objects of natural and historic interest. It contains a traveler's map, with trolley, steamer and railroad lines shown, of Massachusetts, Rhode Island, Connecticut and Long Island, which displays the great extent of the electric-railway network of lower New England. The booklet is sold for a trifling sum at the Old Corner Bookstore in Boston.

The general catalogue of the Bullock Electric Manufacturing company of Cincinnati is an excellent piece of work. It shows the construction of the company's various types of generators, both for belt and direct connection, and also describes and illustrates the well-known motors of the company. The Bullock company has had gratifying success in building and connecting motors for driving printing-presses and machine tools, and much space in the catalogue is devoted to these branches of the work. In its fine new factory the Bullock company, which is the successor of the Card Electric Motor and Dynamo company, is certainly very well equipped for turning out a first-class product, and it is making an enviable reputation for itself.

ELECTRICAL SECURITIES.

The New York and Queens Gas and Electric company has offered $900,000 first-mortgage five per cent. gold bonds, due January 1, 1949, secured by the property of the company, which operates within the limits of the city of New York, in the borough of Queens. Its franchises cover Flushing, Murray Hill, Ingleside, Newtown, Elmhurst, Winfield, Woodside, Corona, College Point, Whitestone, Ridgewood and Forest Park. The New York and Queens Gas and Electric company, incorporated under the laws of New York, has had merged into it the following companies, viz., the Flushing Gas and Electric Light company, the New York and Queens Light and Power company and the Newtown Light and Power company, all of which operate under perpetual franchises obtained from the old municipalities before the adoption of the new charter of the city of New York. It has also acquired by purchase other valuable franchises and rights in the borough of Queens, which it proposes to utilize in due time. The foregoing constituent companies have been supplying Flushing, Murray Hill, Ingleside and other subdivisions of the old town of Flushing with gas and electricity, and Newtown, College Point and Whitestone with electricity. It is the intention of the company to extend its mains to Whitestone, under franchises controlled by it, to supply the demand existing there for gas. It is proposed, also, to further extend operations in this department, taking in other sections of the territory named. The proceeds of the present issue of bonds will put the company in possession of funds with which to make needed changes in equipment, enlarge its main and wire system and provide working capital. At the present time, with three executive forces and with appliances not calculated to produce economical results in all respects, the net income is more than sufficient to meet the interest charges on the present issue of bonds. With certain changes in existing contracts—which will be made shortly—and with the contemplated extensions and improvements effected, the income will be largely in excess of these figures, without counting on the increase which may be expected from the present remarkable growth of the section served. Up to June 1st of this year the increase of the gas output over last year was about 27 per cent., while for the five months ended May 31, 1899, the increase in net income from electric lighting has been about 40 per cent. over the same period of last year.

MISCELLANEOUS.

Professor Allison W. Slocumb of the University of Vermont has been sued by E. E. Miller of Newport, a student at the university, for $10,000 damages. The plaintiff bases his action on injuries said to have been received by him at the hands of Professor Slocumb in the winter of 1897, when the latter endeavored to take a skiagraph of a broken limb.

What promises to be the first permanent installation of Marconi apparatus on this side of the Atlantic is that which is to be used by the government of Trinidad, the southernmost of the Windward Islands, in communicating with its dependency, Tobago, some 20 or 25 miles away. Mr. W. H. Preece, formerly at the head of the British telegraphic service, has been invited to arrange the matter.

"Scientists," says the Philadelphia Record, "are much interested in a fad which W. N. Jennings of this city has been indulging in for the last 18 years, and which, they say, has proven of much value to them. No thunderstorm of any moment passes over the city, no matter whether it is day or night, that does not find Mr. Jennings arrayed in a specially constructed rubber suit, on top of his house, photographing the lightning flashes. When the enthusiastic photographer first started this amusement with his highly sensitized plates he spoiled hundreds of them before he could obtain any satisfactory results. Finally, after two years of futile effort, he discovered the right plan, and now his success is wonderful. This work is considered so important that Lord Kelvin, the world-renowned scientist, has placed himself in communication with Mr. Jennings in order to secure the earliest news of any discovery which the Philadelphia man may make."

TRADE NEWS.

Albert B. Young, manager of the Cling-surface Manufacturing company of Buffalo, spent a few days in Chicago last week in the interests of his product. Mr. Young reports that the demand for Cling-surface is becoming greater every day, and that it is now in use all over the country.

T. O. Moloney, president of the Moloney Electric company of St. Louis, was a recent Chicago visitor. Mr. Moloney reports that the Moloney transformer is being received with favor all over the country and that it is now in use in every state in the Union as well as in many foreign countries.

The entire plant of the Diamond Incandescent Lamp company of Denver, Colo., having a capacity of 1,500 lamps a day, will be sold at auction on Wednesday, July 26th, at 10 a. m. The plant has been appraised at less than one-fourth of its original cost. It is said that this sale will be an opportunity for someone to purchase a complete plant at a very low figure. A. M. Estey, the trustee, may be addressed at 418 Charles building, Denver, Colo.

A dispatch from Trenton, N. J., dated July 8th, says that the Electric Axle Light and Power company, with an authorized capital of $25,000,000, was incorporated on that day. The company is formed for the purpose of lighting, heating, ventilating and refrigerating railroad cars by means of electric power generated by the revolution of the car axle. The company is the outgrowth of the National Electric Car Lighting company of New York.

John S. Nowotny of 313 East Second street, Cincinnati, O., wishes it known that he severed his connection with the Nowotny Electric company March 31, 1898. Mr. Nowotny founded the Nowotny Electric company and managed the business from its incipiency until March 31, 1898. The assignment of the Nowotny Electric company, which occurred June 30, 1899, in no way effects him. After severing his connection with the company he immediately embarked in the manufacture of Nowotny's semi-vacuum long-burning arc lamps and electrical specialties. The latter-named business is owned solely by him and operated under his personal supervision and name, and is not connected with the Nowotny Electric company.

The Rolfe Electric company has been organized in Illinois recently, with a capital stock of $50,000. It intends to manufacture electrical apparatus, and particularly apparatus designed and invented by Charles A. Rolfe of Chicago. Prominent among the Rolfe devices is the Rolfe protector for protecting telephone, telegraph, fire-alarm and similar circuits and instruments against power and lighting currents, lightning and sneak currents. This protector has been perfected by Mr. Rolfe, after 10 years' practical experience in this field. Another invention of his which the company intends to put on the market is a fire-alarm apparatus, which is especially simple and effective in its operation. The office and factory of the company are at 355 North Wells street, Chicago.

Mr. Elmer G. Willyoung makes an interesting announcement. The instrument business lately carried on by him in Philadelphia under the name of Elmer G. Willyoung & Co. has been transferred to Foote, Pierson & Co., 82-84 Fulton street, and Mr. Willyoung will have charge of the expert and selling end of the business of the New York firm mentioned. Carl Waser and John S. Dean, formerly with Willyoung & Co., will also be associated with Foote, Pierson & Co., in charge of the shop work and laboratory respectively. Foote, Pierson & Co. are the successors of the manufacturing department of E. S. Greeley & Co. and are favorably known to the electrical fraternity. Mr. Willyoung will carry on his end of the business under his own name, and states that the contract with James G. Biddle of Philadelphia as sole selling agent has been annulled.

BUSINESS.

A circular and price-list of the Incandescent Electric Light Manipulator company, 116 Bedford street, Boston, is sent on application. Several styles of manipulators and cleaners are illustrated.

The Koh-I-Noor Incandescent Lamp company, 1531 Monadnock building, Chicago, of which A. L. Buchanan is manager, is placing on the market a lamp for which the company claims a number of special features, which should prove interesting to all users of incandescent lamps. Although only recently established, the Koh-I-Noor company is doing a large business and the lamp is said to be received with favor.

To meet the large demand for telephone and electric-light cross-arms the Electric Appliance company of 92 and 94 West Van Buren street, Chicago, has been operating for several years past its own cross-arm factory and has a very extensive plant for this line of work just outside Chicago. This plant has enabled the company to take the lead in this class of material, and it is working its factory night and day to keep up with the demand for these goods.

It is now nearly 10 years since the B. F. Sturtevant company of Boston first began to design and build its own electric motors. Although originally designed solely for fan propulsion, these motors were soon built as independent machines, and to

a still greater extent as dynamos for direct connection to Sturtevant engines. To-day the Sturtevant generating set stands as well established as the well-known Sturtevant fan, and covers a field peculiarly its own—that of the small set, with high-grade and high-speed automatic engine.

That the Bullock apparatus is gaining recognition in the West is shown by frequent sales and numerous inquiries through the Central Electric company, Chicago, as western agent for the Bullock Electric Manufacturing company of Cincinnati. One of the Central company's recent sales was a 75-kilowatt, type H, Bullock belted generator, with all accessories, to the Keota Milling, Light and Power company, Keota, Iowa. This company did not select the cheapest apparatus on the market, but wished for that giving permanently good service.

The Western Electrical Supply company of St. Louis, Mo., reports that on account of its success with the Adams-Bagnall enclosed arc lamps, it has been compelled to add an arc-lamp department to its business. It says that in every case where it has installed Adams-Bagnall lamps the results have been more than satisfactory. Mr. A. W. Dutton, who has so successfully represented the Western Electrical Supply company for a number of years in the South, will hereafter make his headquarters at the company's office in St. Louis and devote his entire time and attention to managing the arc-lamp department.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 4, 1899.

627,997. Automatic Magnetic Circuit-breaker. Paul R. Goldey, Philadelphia, Pa. Application filed October 26, 1898.

The essential features are a hammer, a trigger carried thereby, a locking lever, means for locking the trigger in position, and devices for operating the locking means and the trigger when the current actuates the electromagnet.

628,014. Attachment for Electric Motors. Charles R. Meston, St. Louis, Mo. Application filed November 28, 1898.

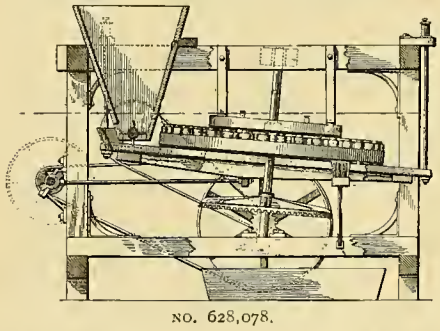
The electric motor which is normally in circuit has mechanical means for laterally displacing the armature of the motor relative to its field magnets, the magnetism of the field magnets being relied upon to restore the armature to its normal position upon the disengagement of the mechanical means therefrom.

628,026. Method of Controlling High-tension Currents. Henry G. O'Neill, New York, N. Y. Application filed October 15, 1898.

The method described of controlling high-tension currents consists in passing them through a terminal into a sealed-in glass tube or closure from which air has been withdrawn, and tapping them off at different distances from the terminal by a metallic contact through the walls of the glass tube, the voltage being regulated by the length of vacuum interposed.

628,046. Repeating and Transmitting Telephone. George K. Thompson, Malden, Mass. Application filed November 29, 1898.

The instrument has transmitting electrodes and a diaphragm, the electrodes and the granular variable-resistance material between the electrodes, a mechanical connection interposed between the diaphragm and the front electrode, the connection being yielding to expansions and contractions of the adjacent parts such as may be produced by temperature variation, but rigid and unyielding under the rapid vibrations of the diaphragm in operation.



NO. 628,078.

628,050. Armature for Dynamo-electric Machines. Henry H. Wait, Chicago, Ill. Application filed June 10, 1898.

An iron-clad armature for dynamo-electric machines is described in which the disks having projecting teeth of substantially the same length as the space occupied by the coil, with disks having similar teeth projecting farther than the others adapted to hold blocks or wedges, whereby the coils are retained in place.

628,068. Telephone System. William W. Bennett, Mesquite, Tex. Application filed December 1, 1897.

The substation instrument includes a pair of receivers and two separate receiver-operated switches, the main line leading to the apparatus in sections which have separate terminal connections respectively, with the separate switches, circuit-wire connections including the switches and the main-line terminals in the bell-circuit, and other circuit-wire connections including the switches in circuit with the two receivers and with the transmitter, whereby the removal of either receiver for use provides for closing the speaking circuit over one section of the main line.

628,078. Magnetic Separator. Alvin Dings, Milwaukee, Wis. Application filed April 20, 1899.

A revoluble horizontally disposed disk is parallel with the conveyor and has a portion overhanging the conveyor and a portion extending laterally thereof, a series of magnets carried by the disk, circuit-controllers for the magnets carried by the disk, and provided each with a stationary and a movable part adapted to make contact with each other, and a stationary device for engaging the movable parts of the circuit-controllers for separating the movable and stationary contacts and cutting the magnets out of circuit while they are out of line with the conveyor.

628,109. Alternating-current Arc Lamp. Gilbert L. Moyer, Hartford, Conn. Application filed April 25, 1899.

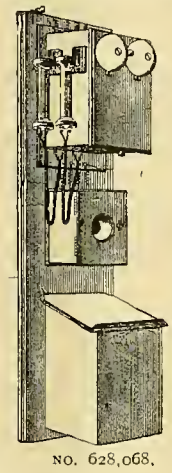
Provision is made for a clutch having a part arranged to open from a carbon a limited distance and having a part arranged to open from the carbon a greater distance, magnets with cores for causing the clutch parts to close against the carbon, and connections between the clutch parts and the magnet cores.

628,113. Apparatus for Indicating the Number of Conversations through Telephones. Carl Petersen, Copenhagen, Denmark. Application filed July 30, 1898.

The signal generator has a spindle and current-collecting brushes, a bellows inflated by turning the spindle, a cut-out which normally renders the generator inoperative on the line, and means operated by the bellows for breaking the cut-out, thereby rendering the generator operative on the line.

628,116. Galvanic Battery. Johannes von der Poppenburg, Charlottenburg, Germany. Application filed November 7, 1898.

This battery comprises a vessel, a cover sealed thereto, a chambered carbon electrode in the vessel projecting fluid-tight through the cover thereof, a depolarizing agent in the chamber of the electrode, an insulating plug closing the lower end of the chamber, a metallic electrode surrounding the carbon electrode and provided with a metallic conductor projecting fluid-tight through the cover of the vessel, a salt of an alkali metal filling the space between the two electrodes and the space between the metallic electrode and the walls of the vessel, and means for introducing water into the spaces, in combination with a bed of a sulphate difficult of solution on which the carbon electrode is seated, and a porous partition surrounding the lower end of the electrode, on which partition the metallic electrode is seated.



NO. 628,068.

628,177. Safety Appliance for Electric Railways. Maurice Hoopes, Lynn, Mass. Application filed June 15, 1896.

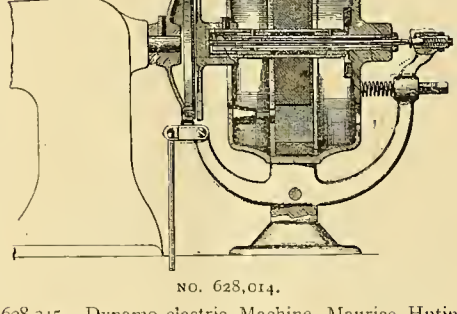
A contact device is connected with the return circuit of the system and normally in contact with a section of the sectional conductor, an automatic circuit-breaker in a branch conductor supplying current to the section.

628,190. Electrical Slow-starting Device for Machinery. Irving Stone, Chicago, Ill. Application filed August 5, 1898.

The shaft is to be driven by a motor geared with the shaft, and an auxiliary motor and slow-motion gearing is interposed between the same and the shaft, and an automatic clutch having one member connected with the slow-motion gearing and the other member connected with the shaft, the members being arranged to be locked together when the auxiliary motor is the driving part and to be disengaged when the same becomes the driven part, whereby the auxiliary motor employed for starting may become automatically disengaged.

628,240. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed July 9, 1898. Renewed April 5, 1899.

In an induction motor-meter there is the combination of the series field-coils, a shunt or volt coil, a transformer having a primary circuit or coil connected to the supply mains and a secondary coil supplying current to the volt coil, an impedance coil in series with the secondary and volt coils, a phase-changing coil connected to the supply mains and in inductive relation to the impedance coil, a variable resistance in series with the phase-changing coil, a revoluble armature, a retarding device and a regulating mechanism.



NO. 628,014.

628,245. Dynamo-electric Machine. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 10, 1897.

The method of reducing the self-induction of a single-phase alternating-current induction motor consists in opposing to the magnetomotive forces of the inducing field-pole coils the magnetomotive forces of the induced armature coils, and rotating the armature by the action of separate field-torque poles upon the poles produced in the armature by induced currents.

628,246. Telephony. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed December 6, 1897.

The method described of transmitting sound by electricity consists in producing upon a line alternating currents the sum of whose normal energy is substantially constant from instant to instant, and varying such energy by and in accordance with sound waves.

628,247. Multiple Telephony and Telegraphy. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed December 30, 1897.

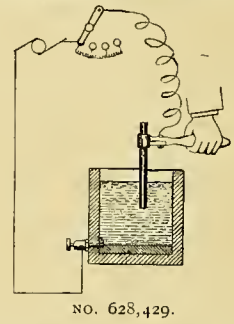
A distributer at each end of the line and a means for synchronizing the distributers in resonant branches of the line are described.

628,325. Electric-clock System. Frank Hope-Jones and George B. Bowell, London, England. Application filed December 29, 1897.

The controlling primary clock is adapted to be wound at intervals by electro-magnetic means. Other features are a going-circuit and generator and a plurality of secondary clocks in the going-circuit, a striking-circuit and generator, a plurality of electric annunciators in the striking-circuit situated adjacent to the respective secondary clocks, and a secondary clock in both circuits provided with means for controlling the striking-circuit.

628,343. Fixing of Insulators for Carrying Electric-line Wires. Werner Menzel, Dusseldorf, Germany. Application filed February 27, 1899.

A stem or pin for insulators is screw-threaded throughout a portion of its length at the end thereof where it engages the insulator, a series of independent angular grooves pass around the body of the pin at right angles to its longitudinal axis, commencing where the screw-threaded portion ends.



NO. 628,429.

628,351. Electrotherapeutic Apparatus. Henry G. O'Neill, New York, N. Y. Application filed October 15, 1898.

The inclosed chamber, transparent or translucent support therein, vacuum electrodes of glass adjacent to the support, metallic electrodes arranged in the chamber so as to produce a decomposing action on the atmosphere when connected with a source of high-tension current, and incandescent lights also adjacent to the support, are described.

628,352. Vacuum Electrode for Therapeutic Purposes. Henry G. O'Neill, New York, N. Y. Application filed October 15, 1898.

A unipolar electrode of glass or other vitreous material contains a vacuum chamber having an exterior contact surface and a single sealed-in terminal designed for connection with a source of high-tension electrical current.

628,358. Method of and Apparatus for Varying the Number of Phases of Polyphase Currents. Henry A. Rowland, Baltimore, Md. Application filed July 16, 1894.

The method of changing alternating current to direct consists in setting up by the alternating currents dephased magnetomotive forces, superposing the magnetomotive forces and producing thereby electromotive forces of a number of phases greater than that of the original alternating current and commutating the current resulting from the magnetomotive forces.

628,373. Electric Furnace. Frank P. Van Denbergh, Buffalo, N. Y. Application filed January 15, 1896.

An electric furnace is described comprising a feeding device, electrodes adjustable lengthwise with reference to each other to vary the length of the arc, and also provided with means whereby the inner ends of the electrodes are vertically movable, independent of the lengthwise adjustment, to change the position of the arc.

628,393. Electric-railway Gate. Thomas O. Cooper, Wilmington, Del. Application filed October 13, 1898.

Electrical-railway gate-operating mechanism is provided, including a stud mounted to move with the gate, a lever in the path of the stud, and a spring to contact with the lever, and a signaling device located at a distance from the gate and provided with a local generator and a local circuit which is connected with the lever and spring, whereby the operation of the gate may be noted independent of gate operator's control.

628,429. Method of Heating Metals by Electricity. Edward M. Bentley, Boston, Mass. Application filed August 20, 1890.

The method of heating conducting material for industrial purposes consists in placing the material to be heated at one terminal of an electric circuit and bringing it into contact with a liquid forming the other terminal of the circuit.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, JULY 22, 1899. No. 4

The Chicago Union Traction Company and Its President.

Since July 1st the new Chicago Union Traction company has been in control of the systems of cable and electric surface railways heretofore belonging to the North Chicago Street Railroad company and the West Chicago Street Railroad company—about 300 miles of track. The new company is capitalized for $32,000,000—$12,000,000 preferred and $20,000,000 common. As everybody knows, Mr. C. T. Yerkes was the principal owner of the two old companies and the president of both. He accepted an offer of $10,000,000 for his holdings in the two companies and agreed to secure the leasing of the lines to the syndicate in consideration of rentals equal to 12 per cent. per annum on the North Chicago stock and six per cent. per annum on the West Chicago stock, these rentals to be guaranteed for the terms of the leases by the deposit in escrow of the shares purchased from himself. It was further agreed that the stock thus put in trust should not be impaired or encumbered in any way. Mr. Yerkes subscribed for $2,000,000 of the peferred stock, carying a bonus of $1,000,000 of the common stock. Chicago was allotted $3,000,000 of the preferred stock, and New York and Philadelphia promptly absorbed the remaining $9,000,000. The cash was called June 26th and 100 per cent. was paid in one day. Of this $12,000,000, $2,000,000 was held for treasury purposes and $10,000,000 was paid to Mr. Yerkes for his stock, less the $2,000,000 which he had subscribed. The principal stockholders in the new company are William C. Whitney, Frederick P. Olcott, Anthony N. Brady, Thomas F. Ryan, William L. Elkins, P. A. B. Widener, H. B. Hollins, R. A. C. Smith, F. E. Smith, E. A. Ballard, Jesse Spalding and Charles T. Yerkes.

About the first official act of President Spalding was the issuance of a formal notice stating that the Chicago Union Traction company had leased and taken possession of the railroads and properties of the North Chicago and West Chicago Street Railroad companies, and that those systems would from July 1st be operated by and in the name of the new company. It was also stated that the board of directors had elected the following-named officers: Vice-president in New York, R. A. C. Smith; vice-president, Walter H. Wilson; general manager, J. M. Roach; treasurer, James H. Eckels; assistant treasurer, L. S. Owsley; secretary, J. C. Moore; auditor, F. E. Smith. All employes and agents of the North and West Chicago Street Railroad companies were asked to discharge their present duties until further orders.

The new administration is making haste slowly. Very few changes have been made as yet. President Spalding and his advisers are undoubtedly considering plans for future improvements, but are disposed to look the ground over carefully and investigate thoroughly before committing themselves to innovations. It has been reported at different times that the "underground trolley" and compressed-air systems were to be substituted for mechanical haulage on the present cable lines, but the prospect of a change of any kind is still indefinite. The president's office is now in the Marquette building, but it is probable that some other downtown location will be secured for the company's office. In Mr. Yerkes' time headquarters were at 444 North Clark street. Mr. Spalding, the new president, is reported as having made this statement: "We have had the property scarcely long enough to do anything with it as yet, but we have found it in even better condition than it was represented to be. We have made a few minor changes and are contemplating additions to our transfer privileges. The greatest need is for more cars, because every car in our barns is now in use. We are planning to use longer cars, and arrangements have already been entered into for securing them."

JESSE SPALDING.

The new president of the Chicago Union Traction company is a man of ripe experience in practical business affairs. He has been prominently identified with the lumber interests of the Northwest, but is also prominent in banking and in other affairs of moment. He was born in Bradford County, Pennsylvania, April 15, 1837, and graduated at Athens Academy. His early life was spent upon his father's farm, and later he was engaged in rafting logs down the Susquehanna River and Pine Creek. It was not long after this before the young lumberman was buying lumber for his employers, and at the age of 23 he was buying and shipping for himself. He went West in 1860, and realizing the possibilities of Chicago as a lumber market, he determined to establish himself in this city. Accordingly he built mills at Menekaunee, Wis., and also at the mouth of the Cedar River, and established a sales yard in Chicago at Lumber and Twelfth streets. He was largely interested in the opening of the new lumber district at Twenty-second street, which then had no street-car connections. It was largely through his energies that the Lake Michigan Ship Canal and Harbor company was organized, which opened a canal across the peninsula between Sturgeon Bay and Lake Michigan, which shortened the lumber route to Chicago by 150 miles. In 1892 the government purchased the canal and made it free to the public.

JESSE SPALDING.

Mr. Spalding built Camp Douglas in Chicago at the breaking out of the Civil War. This was an undertaking of magnitude, and Mr. Spalding's patriotic and energetic fulfillment of his contract brought him into prominence. Mr. Spalding has always been prominent in the councils of the Republican party, and in 1883 President Arthur appointed him collector of the port of Chicago. In 1889 President Harrison appointed him one of the commissioners for the Union Pacific railroad. Under Mayor Colvin Mr. Spalding was for three years a member of the City Council, and, as chairman of the finance committee, was instrumental in completely restoring the financial credit of the city. At present he is a director in the Commercial National, Garden City and Hibernian Banks, and president of the Spalding Lumber company as well as of the Chicago Union Traction company. His long residence in Chicago, his sagacity and his wide experience make it certain that the affairs of the new company will be ably directed.

O. A. Cooper contemplates establishing an electric-light plant at Humboldt, Neb.

Three-cent Fares in Detroit.

As an outgrowth of the agitation for municipal ownership of the street-railway lines of Detroit, the residents of that city are now paying three cents each for street-car rides. The change went into effect on July 14th, but is believed to be only temporary, as the ruse of securing a 48-year franchise for the companies thereby seems to have failed.

The scheme was this: When the Supreme Court knocked out the McLeod Municipal Railway Commission by declaring it unconstitutional, Governor Pingree and Elliot G. Stevenson, who were later joined by J. C. Hutchins, proposed to buy the existing lines for $17,000,000, and to have the city guarantee the bonds to this amount. This commission was to operate the roads and to give three-cent fares and universal transfers. In case the scheme proved a failure and the roads did not pay, they were to revert to Tom L. Johnson and his present partners owning the roads, and as a guarantee for this the city was to issue a 48-year franchise to Johnson and his associates, which should become operative when the experiment of three-cent fares proved a failure. The "security franchise" was passed by the aldermen by a vote of 19 to 14 on July 11th, but there was intense opposition and cries of "boodle." The mayor promptly vetoed the ordinance. The next step was the announcement of the three-cent rate by the companies on the 14th. Governor Pingree issued circular after circular, stating that the scheme was in the interest of the people, but press and public were very incredulous, as estimates of the value of the 48-year franchises were from $20,000,000 to $40,000,000.

The affair caused a great deal of excitement, but as public opinion seemed to be opposed to the 48-year franchise scheme, even with three-cent fares tacked on, it looks as though the whole Johnson-Pingree scheme would fall through. The ordinance can hardly be sustained over the mayor's veto; and it is probable that the old five-cent rate will be restored while the companies endeavor to make the best terms they can in extending their franchises.

Recent Electrical Fires.

In reviewing the electrical fire record for the period from April 10th to July 10th, Mr. W. H. Merrill, Jr., the electrician of the Underwriters' Electrical Bureau, says:

"An unusual fire was caused by the focusing of the sun's rays by an electric-light bulb, which set fire to a curtain in the window of a residence.

"A four-ton load of hay was destroyed by fire caused by grounding of trolley current through binding wires of hay while load was passing through a subway. The hay was completely consumed, but the fire department saved the truck.

"A falling tree was the indirect cause of two fires several miles away and the temporary suspension of traffic on an electric road. The tree, in falling, carried down some wires of a telegraph company, crossing them with the trolley wire. The heavy current from the latter followed the telegraph wire 20 miles and set fire to two telegraph switchboards. In both cases the fires were quickly extinguished. Business on the electric railway was suspended an hour.

"The usual number of summer fires due to lightning discharges entering buildings over electric-light circuits is reported.

"Troubles from the crossing of signal circuits with light and power wires seem to be increasing in cities where overhead construction is still permitted. Losses in such cases are principally confined to switchboards and transmitting instruments, and are invariably aggravated by the presence of wires having paraffine insulation, in risks where their use has been countenanced.

"The serious effects of high-tension current on low-potential circuits are again illustrated by several fires. Such occurrences sufficiently emphasize the necessity of a rigid observance of the rules in construction work inside buildings.

"Three deaths from contact with live wires and one from the breaking down of the insulation of a transformer have been reported."

Mr. Sprague's Description of the Multiple-unit Electric-railway System.

Before the American Institute of Electrical Engineers, on May 16th, Mr. Frank J. Sprague read a long and long-expected paper on the "Multiple-unit System of Electric Railways." Mr. Sprague prefaced his account of his system by an extended review of electric-railway development. The multiple-unit system, says Mr. Sprague, may be briefly described as a semi-automatic system of control which permits of the aggregation of two or more transportation units, each equipped with sufficient power only to fulfill the requirements of that unit, with means at two or more points on the unit for operating it through a secondary control, and a "train-line" for allowing two or more of such units, grouped together without regard to end relation or sequence, to be simultaneously operated from any point in the aggregation.

Describing in particular the car equipment of the Alley "L" road in Chicago, on which the multiple-unit system was given its first practical trial, Mr. Sprague says:

It has been already pointed out that the multiple-unit system is an aggregation of transportation units of variable size, each equipped with the power required to operate that unit at a given schedule and under determined conditions, with means for controlling the aggregation from two or more points. This does not necessarily mean that every car is equipped; that depends upon the schedule and the requirements of acceleration, for the method is equally applicable whatever the number of cars that are equipped with motors or the number of motorless or "train-line" cars which are mixed in with them. For example, a train can be made up of pairs, each of which forms a transportation unit consisting of one motor and one motorless car, so that the train

Fig. 5. Exterior View.

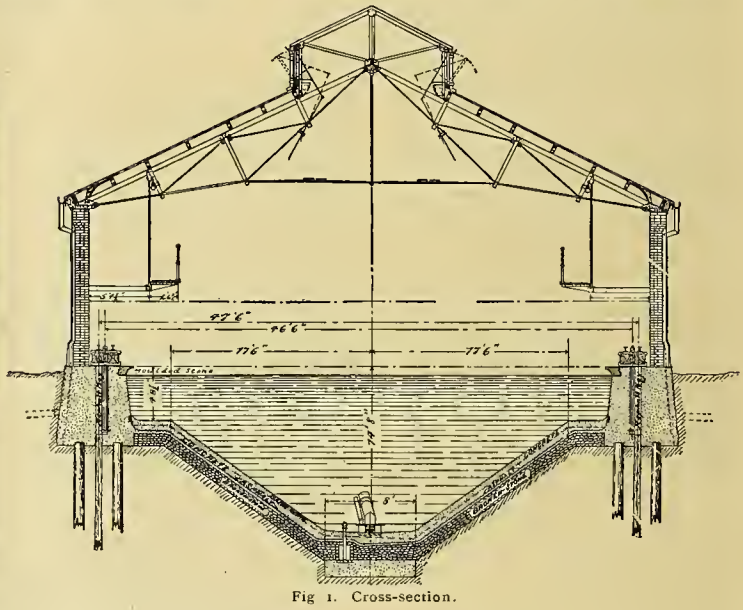


Fig 1. Cross-section.

BASIN FOR SHIP MODELS AT WASHINGTON NAVY YARD.

can be made up of two, four or six cars, that is, one, two or three couples, thus averaging one motor per car in use. Three and five-car trains can be made up, the third and fifth being a motor car or a train-line car. In any case, two-motor equipments can be put on one-half of the cars and the balance equipped with a "train-line" so as to get one schedule, and when it is desired to increase the schedule motors and a controller can be added to the partially equipped cars.

Of course, the finality of the system on roads with frequent stops, to get the maximum schedule speed, is a motor on each axle, but in a large number of cases and with pivot-truck cars, commercial demands are such that two motors per car are sufficient, and on some service two motors on alternate cars only.

The equipment of the South Side road has been made on a mixed plan, 120 cars first being each individually equipped with two motors, then 30 cars with a "train-line," but without motors, and finally 30 additional cars completely equipped.

The position and arrangement of the South Side yards and the running of trains into a Y at one end and around a loop at the other produces every possible aggregation of cars. Hence, for the equipment, in order to avoid head and tail switching, and to permit of this variable aggregation, there was one vital condition, which was that no matter how trains were made up, like hand movement at the end of any car must at all times mean like track movement relative to the operator, and the system of connections from one car to another must automatically provide for such a result.

The Cab

This variation of car aggregation, and the further condition that no seat-room should be taken up by the motorman, made it necessary to provide each car with a movable cab on the platform such that it could be left open for the free use of the ordinary entrance gate when in the body of the train, and yet be readily closed and afford protection to the motorman when at the leading end, at the same time allowing free passage from one car to another. On each car, therefore, at the right-hand diagonal corners the ironwork has been removed and a three-part cab constructed, the outer end being a fixture with a drop window, and carrying in the angle formed by the platform the initial controlling mechanism, being the master controller for the electrical system and the engineer's valves for the air brakes. On each side is a door, each hinged in opposite direction, and folding back one over the other against the header of the car, leaving, when in this condition, the platform clear and the ordinary gate in operation.

When used by the motorman, one or both doors are closed, the iron gate swung in place, and a small protecting cab is the result.

Motors and Controllers.

Under one end of the car, in place of the ordinary truck, is a motor truck carrying two 50 horse power (hour rating) standard railway motors of capacity and gearing such as to safely allow the motors to work up to the skidding point of the wheels with 60 per cent. of the weight of the car equipment and load upon them.

The motors are of the General Electric manufacture and of the usual Sprague suspension.

In the hood of each car is a controller for the motors enclosed behind a trap-door which can be lowered for ready inspection. The controller is of the multiple-series type, is driven by a small pilot motor, and provision is made for at will or simultaneously producing a step-by-step or interrupted or periodic forward movement of the controller, and a continuous or interrupted return movement of it to the off position through various automatics connected with the pilot motor and the initial control circuits.

In addition to the current-varying controller, there is a main reverser, likewise operated by the same agencies as the pilot motor, for determining the direction of the current delivered to the motors, and for instantly opening the circuit of the motors in case of emergency.

Inside of each cab is a small master controller or operator's switch mounted on a standard and fastened to the woodwork of the cab. Through this master controller the pilot apparatus of the current-varying controller and the reversers are governed. It is provided with a movable handle operating a spring-retracted spindle which, through various degrees of movement, makes contact with the reverser circuit and with three determinate positions—coast, series and multiple. Momentary contacts on these various points give any desired intermediate position of the main controller, which has a stepped movement. In order to maintain the controller at any point, or to keep the governing circuits or train-lines energized, the handle of the master controller must be held in position. If the handle is released, whether from accident or design, the spindle instantly returns to coast position, and the controller automatically returns to the off position and cuts off the current, or if the master controller is allowed to go to the center position, the reverser is instantly opened and the controller then comes to open-circuit also automatically.

The arrangement of circuits is such that by the use of a relay and throttle and the proper interconnection between the controlling circuits, the operator is at liberty to do about as he pleases with the master controller, and can rely upon the main controller operating satisfactorily.

For example: He can go to the series or to the multiple position, or from the last reverse movement instantly, and the controller, instead of responding instantly, responds progressively, the pilot being limited in its movements by increment of the main current to or above any definite amount.

The throttle is set just short of the skidding point of the wheels on a normal track, allowing 15 per cent. adhesion, and absolutely limits the current input to that which is required by the determined rate of acceleration. Any rate less than this can also be effected by proper handling of the motor controller, so that any movements, no matter how refined, are perfectly possible.

This throttle is in the circuit of one motor only, so that it is equally effective whether in the series or multiple position.

Although there is a master controller on each platform, their construction is such that interference with them is difficult, and has never been known to occur.

The "Train line."

So far, the system described is that of a secondary electric control of a single controller, but by paralleling the relay and other circuits it is evident that the two or more equipments on a single car can be operated, and also that if these equipments are put on different cars they can likewise be operated, provided means exist for properly connecting the prime controlling circuits and insuring practical synchronism of the different controls and equal work on the different motors. Where the equipments, however, are on different cars, it then becomes necessary to have a "train-line" and couplers, so that a governing circuit which can be energized at various points is made up of a "train-line" individual to either car and couplers of some kind between them.

This "train-line" is necessarily an independent line, not being a part of the main motor circuits on any car. It can be energized, of course, from any electrical source, but for convenience the main source of supply is the one used.

This "train-line" consists of five wires perfectly insulated, made into a common cable permanently located in the car and terminating at each platform in one or more couplers, in this particular case in a pair of couplers, one under each corner of the platform, these couplers being shrouded so as to prevent dirt or rain entering them.

When trains are made up the train-lines are connected by a reversible jumper having corresponding wires, and the system is so disposed and connected that no matter from which corner the connections are made, or how the cars are reversed or altered in sequence, the circuits are automatically established such that like track movement is always assured with like hand movement of the master controllers.

The section of train-line in each car is not a part of the normal controlling circuit individual to the control equipment, but is connected with it with switches, which enables a severance of the two systems, that is, the local-car system and the train-line, so that no matter how trains may be made up, it is always possible to disconnect the controlling mechanism of any train for any purpose whatever.

The practical result of the system is that every aggregation of cars, whether one or more, has identically the same characteristics in the matter of load, capacity, motor-equipment, rate of acceleration, etc., as are possible with a single car, and every combination is made without the slightest thought being given to pairing of electrical circuits.

Air Brakes.

Each car is equipped with an automatic air-brake system, supplied by Chrisensen air compressors, with a reserve tank, and an equalizing pipe running from car to car, the compressors being started and stopped automatically through an air-governed switch by fall and rise of air pressure.

On each platform, alongside of the master con-

troller, is a small engineer's valve, so that from any selected cab the air brakes can be operated with equal facility.

A balance wire runs throughout the train, and is included in the same coupling as connects up the electrical train-line, so that when an air governor on any car closes circuit, all compressors start and continue in operation until the last governor throws out. This is to effect equal work on the various compressors and to maintain absolute certainty of air supply at all times.

Automatic Protection.

If a train should part, three systems of automatics come into play. The reversers go to open circuits, the controllers to the off position and the air brakes also automatically operate.

If the main circuit fails, all reversers open instantly and the controllers must come to the off position, which they will do automatically as soon as current is restored, before current can again be put in the main motors.

So, too, if there is an instant reversal of the master controller. The reversers first open circuit, the controllers return to the off or any determined position, then start again, and are instantly arrested on the first contact. Provision is made so that it is impossible to run backward at more than one-half speed from any platform when operating from that platform.

Performance.

For several weeks, on account of lack of equipment, the motors on the equipped cars in the morning and evening hours were subjected to a regular increase of load of about one-third, and at times every motor car has been in operation. The economy of quick acceleration for high schedules has been thoroughly demonstrated. When coasting freely, on test, with car making 15-mile schedule, and under the conditions of grade and station intervals on the South Side road, the energy used at the car was about 73 watt-hours per ton-mile.

A very large number of records has been taken by Mr. Lundy [of Sargent & Lundy, the consulting engineers for the South Side Elevated Railroad company], these running into the hundreds, under all possible conditions of acceleration and all sorts of motor and trail-car combinations, for determining the best methods of operation, the highest degree of economy under various loads, and for ascertaining track, car and gear resistances, resulting in a very satisfactory equation with speed and weight as factors. These are conclusive of the benefits of this method of operation, independent of the influence on passenger traffic of high-schedule speeds and short-time intervals.

The system was put to the hardest test on October 19th, Jubilee Day, and although operating with only 148 cars on nearly 20 miles of total trackage, 240 cars per hour were sent into and out of the loop at Congress street, hour after hour, without a hitch. This was done by reversing trains at cross-overs at three or four different points, thus intensifying the car movement where traffic demands were greatest.

On this particular day, when the car mileage was increased about 80 per cent., and with very heavy loads, the central station had six 400 horse power (standard rating) boilers only in use, with but two

[*Continued on page 54.*]

Basin for Ship Models at Washington Navy Yard.

Aside from its general interest, the new United States experimental model basin at the Washington navy yard forms an exceptionally valuable study to electrical men, inasmuch as the machinery in it is electrically operated, with several new applications.

The value of towing experiments upon small scale models of ships for the purpose of deducing the resistance of a full-sized ship from that of the small model was demonstrated by the late Mr. William Froude, who, at his own expense, started a small tank for such experimental work at Torquay, England, about 1870.

The value of towing experiments upon small-Navy Department has appreciated for many years the value of an experimental basin, but it was for a long time unable to secure an appropriation for the purpose. Congress finally, about two years ago, granted $100,000 for this work. The basin proper was completed the latter part of last year, and the special machinery and apparatus have now been completed and installed.

The basin is located in the southeast corner of the Washington navy yard. The accompanying illustrations give a very fair idea of the external and internal appearance, and Fig. 1, p. 46, shows the construction of the main body of the tank proper. The building (Fig. 5) is 500 feet long and about 50 feet wide inside. The water surface of the basin is slightly shorter than the building, being about 470 feet long. The deep portion is about 370 feet long, the south end, from which runs begin, being shallow. The water surface is 43 feet wide, and the depth from top of coping to the bottom of the basin is 14 feet eight inches. The basin is materially larger than any other in existence.

The law authorizing the construction of the model basin also authorized experiments to be made for private shipbuilders, provided they defrayed the actual cost of the same, it being understood, of course, that such experiments should not interfere with naval work. This being the case, it was necessary to lay out the plant with a view to the rapid and economical turning out of routine experiments, and to this end the endeavor has been throughout to use machinery for as many of the operations as possible. Wood has been adopted as the material for the models, and after some difficulty a satisfactory varnish was found which rendered the surface of the wood to all intents and purposes absolutely watertight. The standard length of model used is 20 feet.

The method of building the model is as follows: The "lines" of the ship invariably include a body plan giving sections at moderately close intervals. From this body plan new sections are drawn to the proper size for a 20-foot model, by means of the eidograph or large pantograph. These sections are cut out of paper, and then transferred to wooden boards, which are sawed to shape. These boards are next erected in their proper relative positions upon the erecting table, each board section being clamped in a vertical plane. They are then covered with battens about one-half inch thick and tapering from amidships toward the end, making a "former" model, the surface of which is planed smooth. In cutting out the sections allowance is made for the thickness of the battens which have to be nailed upon them. Meanwhile a rough block of shapes and dimensions to enable the finished model to be cut from it has been prepared and glued together under pressure in a large hydraulic press. This block is placed upon the upper table of the model-cutting machine, illustrated in Fig. 2, p. 48, the "former" model being placed upon the lower table. The model-cutting machine works upon the principle of the Blanchard lathe, a roller transversing the surface of the "former" model and saws or cutters working upon the surface of the model proper. The bulk of the material is removed from the block by means of the saws, which are shifted along a short distance at a time. Rotary cutters are then applied which finish the surface of the model very close to the desired shape. The model is then removed from the cutting machine and finished by hand, a very small amount of hand work, however, being found necessary. It is now ready for varnishing and the attachment of any appendages, such as bilge keels, struts, etc. It is finally taken to the measuring machine and careful measurements made of its exact form and shape, which not only enable the staff to determine whether the model represents the lines desired, but gives an exact record of the actual shape.

The model is now ready for the towing experiments. Figs. 3 and 4 show the carriage used in this work, Fig. 4 showing the observers in position upon the carriage. It runs upon eight wheels and spans the full width of the basin, as shown. The platform in the center, carrying the recording apparatus, can be raised or lowered at will. Electricity is used to drive the carriage; in fact, electricity is used for all mechanical work in connection with the model tank. The speed of the carriage is varied, not only by making various combinations of the four motors—one to each pair of driving wheels—but by controlling the output of the generator in the power station, which is, perhaps, 100 yards from the tank. This control is on the Ward Leonard system, and is very similar to that used to control the motion of heavy turrets on board ship. By means of a resistance box on the carriage the current through the field-coil windings of the generator is increased or decreased at will. The revolutions of the generator being kept constant by a delicate governor, the amount of current generated varies with the amount of current through the field coils of the magnet. The whole of the current generated is passed through the motors, and in practice it is found that a very exact regulation of speed is obtained by this combination. The carriage itself, with its fittings, weighs in the neighborhood of 25 tons, so that it alone forms a kind of flywheel, and is not subject to sudden variations of speed. The speed of the carriage can be varied from .1 knot an hour, or 20 feet a minute, to 20 knots an hour, or 2,000 feet a minute.

The principal difficulty in connection with the use of high speeds, which, while not necessary for the bulk of the experiments, will be of great value in certain special experiments, is to stop the carriage when it is once under way. The electrical control acts as a brake, because when the current is shut off the motors become generators, but this could not be relied upon for high speeds, since the sudden rush of current due to possible unskillful manipulation would throw the circuit-breakers, thus opening the circuit and cutting off the current en-

FIG. 3. BASIN FOR SHIP MODELS AT WASHINGTON NAVY YARD.—INTERIOR VIEW SHOWING TOWING CARRIAGE.

tirely. For these reasons there is at the north or terminal end of the basin a double system of brakes to take hold of the carriage. The first is a friction brake consisting of two strips of iron on either side pressed together by hydraulic cylinders. These are forced apart by a slipper on the carriage about 10 feet long, which, as well as the brake strips, is kept thoroughly oiled, so that the coefficient of friction for stopping, though low, is fairly definite, and sudden jerks are avoided. The pressure in the hydraulic cylinders is controlled by an accumulator and a pump driven by electricity. Great care has been taken in connection with this part of the installation that it may be always in working order, and any trouble or breakdown, except that of the pump itself, which runs all the time, will simply result in setting the pressure at maximum. This maximum is 600 pounds, but it has been found by actual experiment that with 500 pounds pressure the carriage is brought safely to rest when it enters the brakes at a speed of 20 knots. It is not expected in practice to repeat this often, since even for the high-speed runs the electrical brake will be used to reduce the speed of the carriage before the friction brake is used. In addition to the friction brake there is what is called the emergency brake, so that in case the friction brake fails for any reason, the carriage would still be caught. This brake consists simply of a piston about 16 inches in diameter, working in a cylinder which is submerged in the water of the tank and connected by wire cables to a hook which takes hold of the carriage. The head of the cylinder has a round hole and the piston rod is tapered so that as the rod is drawn out by the motion of the carriage the hole is gradually closed, the whole being almost exactly upon the principle of the hydraulic-gun recoil brake. An escape is provided for the water around the piston when it starts from rest to avoid sudden accelerations from the whole mass of water in the cylinder.

The dynamometric apparatus is designed to avoid entirely the use of multiplying levers or other devices involving the possibility of friction, and here again electricity is enlisted. The recording drum is fitted with apparatus for recording the time and distance, as usual. The resistance is measured directly by a spring. The forward end of the spring is attached to a bracket, which is screwed forward or back by an electric motor, and a rigid arm runs up from the bracket, with a pencil recording its position on the drum. The record then is of the position of the forward bracket. The after end of the spring takes hold of a small cross-head, to the other end of which, again, is attached a towing rod which takes hold of the model. This cross-head has a very slight play between stops in the after fixed bracket, and when it touches either stop closes an electrical contact, which again throws an electric clutch by means of which the motor, running all the time, screws forward or back the forward bracket, thus increasing or decreasing the tension of the spring until the contact is opened again.

The operator can throw either clutch at will or set them to work automatically. In practice, when about to make a run, the operator works the bracket forward to the immediate vicinity of the position which he knows it will assume during the run, the approximate speed of which he knows. The carriage is then started, and after a uniform speed has been obtained, which, for speeds up to 12 knots, is done within 50 feet, he throws in by a single motion of one handle the automatic appliances which start the drum and record time, distance and resistance. In this way the resistance pen has to move but a small distance to reach the position of equilibrium and almost immediately becomes steady. It will be seen that with this device friction is eliminated. The accuracy obtainable depends upon the closeness with which the automatic stops at the after end of the spring can be set. In practice it is found that these can be set to give a play of about the fiftieth of an inch, and as the springs will extend 10 inches, the results obtained are practically exact as indicating the pull of the spring.

There is fitted at the starting end of the basin a kind of weighing machine with one vertical and one horizontal arm. This is delicately balanced, and when the model has been connected up and is ready for towing, a certain spring being in use, the vertical arm, or rather a knife edge which bears upon the vertical arm, is connected to the model. A known weight is then put into the scale pan attached to the horizontal arm. The automatic attachment in connection with the dynamometer spring is thrown into gear, and the weighing machine is screwed forward or backward until it is in perfect balance and the record pen recording the position of the spring is at rest. It is evident then that the pull of the spring is exactly equal to the weight in the scale pan. There are a number of pens which can be shifted parallel to the recording pen and set in a definite position to record upon the drum. One of these pens is set to correspond to the position of the resistance pen, then another weight is put into the scale pan, a second pen set to record the resistance, and so on. It is evident then that when the run is made these fixed pens mark off upon the paper a scale for resistance, avoiding all complications of corrections for temperature of spring or anything else. A complete double outfit of springs is already provided for measuring resistance from one pound up to 500 pounds, and for special work additional special springs will be obtained.

The basin is filled from the water system of Washington and will hold 1,000,000 gallons. Two electrical centrifugal pumps are provided, the larger of which will empty the tank in about four hours. The smaller pump is a four-inch pump, used for draining the last water from the basin and also for pumping the water from outside the basin, to avoid the possibility of undue pressure upon it in case it is left empty for some time. This is necessary, since the basin is but a short distance from the Potomac River and extends eight or nine feet below mean tide level. A gauge indicates the level of the outside water, which is found to be, as a rule, about six feet below the water in the basin.

The leakage from the basin, which is very slight, and the evaporation are made up with filtered water, an animal-bone filter being installed with a capacity of from 50 to 100 gallons a minute, depending upon the turbidity of the water. In practice a small stream of fresh filtered water is kept running into the basin all the time, and the level maintained wherever desired by an adjustable overflew.

The building and tank or basin proper were designed by the Bureau of Construction and Repair, as well as the machinery for making models. The electrical installation was fitted by the General Electric company, many of the electrical details of design being also due to that company. The carriage proper was built by the William Sellers company, the dynamometer apparatus partly by the Sellers company and partly by Saegmuller of Washington, who also built the large eidograph. All of these are upon the designs of the Bureau of Construction and Repair. The model-cutting machinery was built by Detrick & Harvery of Baltimore, Md., to the designs of the Bureau of Construction and Repair.

For the information and illustrations in this article the Western Electrician is indebted to the Scientific American.

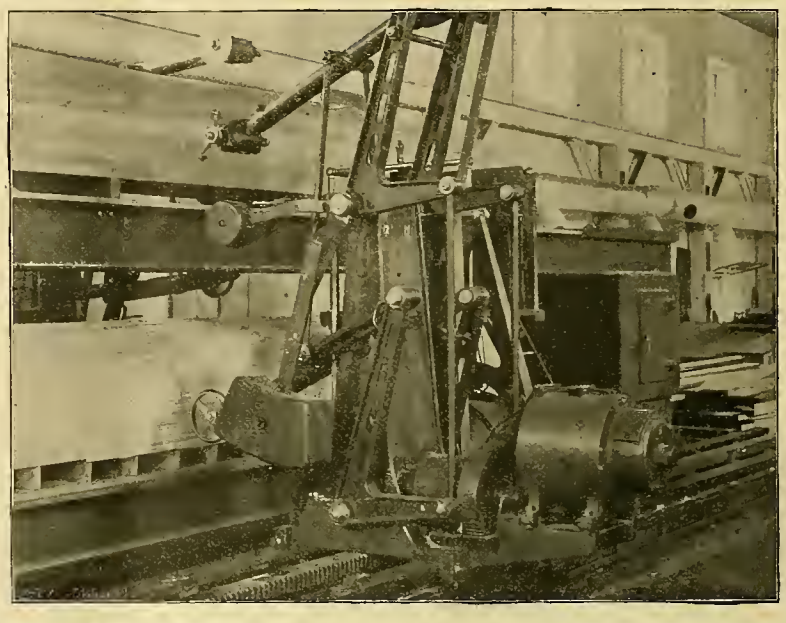


FIG. 2. BASIN FOR SHIP MODELS AT WASHINGTON NAVY YARD.—MODEL-CUTTING MACHINE.

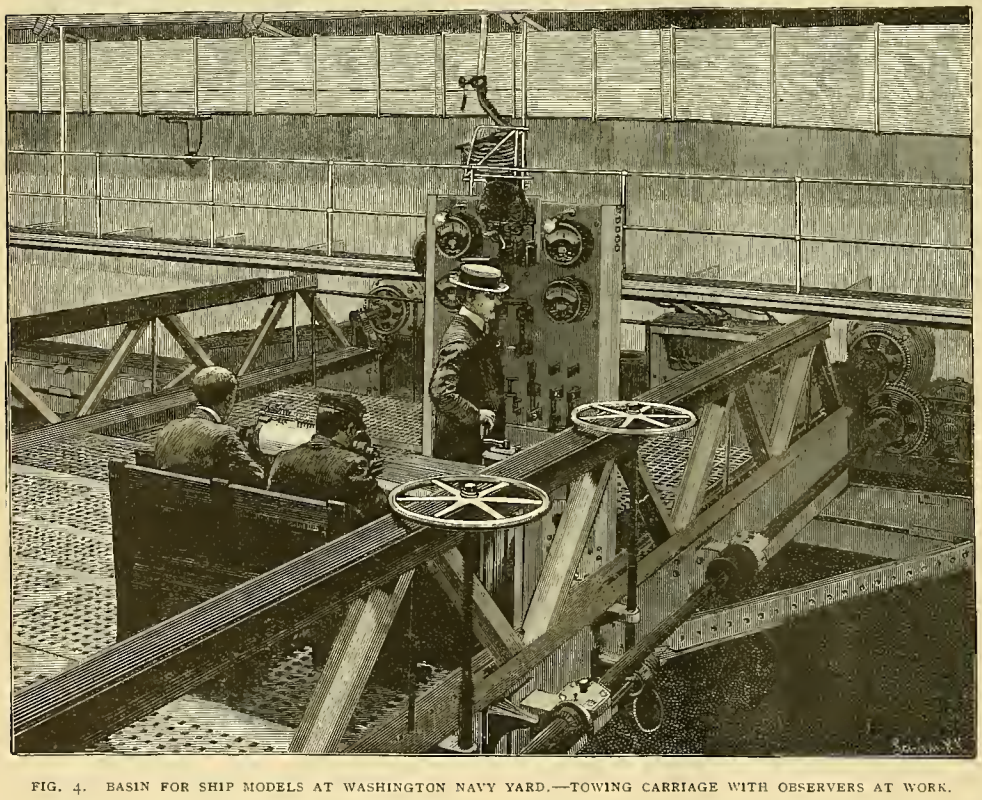


FIG. 4. BASIN FOR SHIP MODELS AT WASHINGTON NAVY YARD.—TOWING CARRIAGE WITH OBSERVERS AT WORK.

American Electro-therapeutic Association.

The American Electro-therapeutic association will hold its ninth annual meeting at Washington, D. C., September 19, 20, 21, 1899. The president, Dr. F. B. Bishop, has appointed the following committee of arrangements: Drs. D. Percy Hickling (221 Third street, N. W., Washington, D. C.), chairman, Jos. Taber Johnson, G. Lloyd Magruder, Z. T. Sowers, Robert Reyburn, G. Betton Massey, Charles R. Luce, Elmer Sothoron, Llewellyn Eliot, Clifton Mayfield. Willard's Hotel has been chosen for the headquarters and special rates have been made for all interested in this meeting.

Many papers have been promised, and a very successful scientific meeting is assured. There will be a large exhibition of electro-therapeutic apparatus in Willard's Hall during the meeting of the association. The committee also promises a pleasant social programme, including a reception by the president of the United States, an excursion to Mount Vernon, Arlington and Alexandria (a buffet lunch to be served at Alexandria) and an evening visit to the Congressional Library, to be viewed under electrical illumination. Provisions have also been made to visit the War, State and Navy Departments, the United States Treasury and other public buildings.

Electric-railway Work in the City of Mexico.

Although the rainy season set in last month, progress continues in the work of transforming the Guadalupe and San Angel lines of the District railway in the City of Mexico from mule haulage to electric traction. However, the weather does interfere with the track and overhead work after midday. There is still some little work to be done in the center of the city, changing from the old light-weight rails to the new 85-pound, 60-foot girders. This has been a difficult proposition for the company to overcome, owing to the crowded condition of the streets and tracks. The construction department, however, has been able to cope with this feature by devising temporary tracks and bridges, over which the present service passes without interference to or from the new work. The city officials, appreciating the advantage of the change in service, have given every assistance to the management in the work. Fig. 1 gives an idea of how the work is going on.

The power house (Fig. 2) is a large building, located in Colonia, Indianilla, south of the city, and, with its boiler house and coal storage, presents a substantial and business-like appearance. The three buildings are of structural steel, the walls, of stone and "tepetate," being erected after the steel structure and roof were completed and the greater part of the steam and electrical machinery on the foundations. This method of erecting machinery in an unenclosed building shows the dependence placed on the regularity of the climatic conditions in Mexico.

The equipment at the power house is, in brief, as

Fig. 1.

follows: Three batteries of Babcock & Wilcox water-tube, high-pressure boilers, together with their pumping, heating and economizing apparatus, supplying steam to two McIntosh & Seymour cross-compound, condensing engines, each direct-connected to one General Electric 425-kilowatt, 550-volt, direct-current generator, operating at 100 revolutions a minute. In addition, there is one McIntosh & Seymour single-cylinder high-speed automatic engine, direct-connected to one General Electric 25-kilowatt generator; this latter unit is for use in lighting the several buildings, car sheds, machine shops, etc., with arc and incandescent lamps. Beside the machine panels, the switchboard will have eight feeder panels, the generator and feeder panels being equipped with the full quota of recording and safety devices.

Fig. 3 shows a portion of the interior of the building during the erection of the machinery and the general construction of building before the completion of side walls. The 25-ton traveling crane is also partially shown. With this hoisting device the parts—some pieces weighing 25 tons each—of the engines and electric generators were conveyed from the freight cars on which they were received and placed in their relative positions for assembling with the greatest ease.

The original rolling-stock equipment will comprise 35 18-foot special car bodies, measuring 27 feet over platforms, built by the J. G. Brill company of Philadelphia, Pa., arranged with cross-seats and long, wide windows, which, when lowered, will tend to convert the cars from "closed" to "open." This feature will be greatly appreciated in the semi-tropical climate of Mexico. The cars will be mounted on extra heavy Brill trucks, and the electric equipment will consist of two General Electric railway motors of 35 horse power capacity each, complete with their controlling devices. The cars will also be lighted with incandescent lamps, and suitable head and signal lights will be installed. It is the intention to use the new cars for first-class passenger service, and to haul some of the old mule cars as trailers, for the second-class traffic.

The general supervision of the work is under Mr. A. E. Worswick, vice-president and resident engineer for the District Railway company, assisted by a capable corps of assistants. The installation of the boilers and auxiliaries is under the direction of Mr. J. Pereira, representative of the English Babcock & Wilcox company in Mexico. The engines and condensing apparatus were installed by engineers direct from the McIntosh & Seymour shops at Auburn, N. Y. The electrical apparatus furnished by the General Electric company of Schenectady, N. Y., is being installed by engineers of the Mexican branch—the Mexican General Electric company.

The facts and illustrations in this description are taken from Modern Mexico.

Public Lighting in Detroit.

The latest annual report of the Detroit lighting commission shows a better record than any before made. There is a marked deduction in expenses. The cost of maintaining the lights has been brought down to $46.46, according to the figures given. The total amount of money expended for the 12 months

Fig. 2.

Fig. 3.

ELECTRIC-RAILWAY WORK IN THE CITY OF MEXICO.

ended June 30th will show the following comparisons with the previous year:

Department.	1899.	1898.
Maintenance	$17,413.59	$16,305.61
Executive	8,172.13	8,470.57
Station	41,251.98	42,087.44
Lighting	29,345.06	31,805.47
Shop	122.17	716.39
Injuries and damages	360.10	327.70
Total	$96,665.03	$99,713.18

In 1897 the total amount expended was $110,141.48. The average number of street lights operated was 1,911, against 1,744 in 1898 and 1,564 for 1897. Of these, 39 are arc lights on Belle Isle. The number of incandescent lights operated in the public buildings of Detroit was 977; on the island, 934.

The electric output was 3,539,567 kilowatt-hours, against 3,281,115 for 1898 and 2,890,412 for 1897. The amount of coal consumed was 18,166,432 pounds, against 17,075,525 for 1898 and 15,032,130 for 1897. This, reduced to the number of pounds per kilowatt-hour, is 519, against 523 for 1898 and 499 for 1897.

Each arc lamp was operated an average of 3,811 hours and five minutes, or a nightly average of 10 hours and 25 minutes. The cash cost for each arc light is placed at $46.46, against $51.85 for 1898 and $64.19 in 1897. The principal deduction in the cost of light was in the trimming department, through the introduction of long-burning carbons, at the suggestion of Commissioner Ingram.

[The figures given are furnished by the Detroit correspondent of the Western Electrician. It should be remembered, in considering them, that no allowance appears to be made for depreciation, taxes, insurance and water. The Detroit plant appears to be operated with greater efficiency than formerly, but it is not credible that 450-watt arc lamps can be operated at a cost of less than $47 a year, if all items properly entering into the cost are taken into account.—Ed.]

Naming the Horseless Carriage.

While the word "automobile," as the generic name for the self-propelled vehicle, is not etymologically perfect, it seems, nevertheless, to be firmly fixed. Still, there are those who object to it, and many suggestions are made.

Mr. C. E. Woods of the Fischer Equipment company of Chicago writes: "The name I wish to suggest to the public is the name 'autobaine,' which, translated, means automatic wagon—baine being derived from an old Greek word meaning wagon; so we have, for the name of the vehicle, autobaine, autobaineer, as applied to a man operator, autobaineeress, as applied to a woman operator, and autobaining or autobaineering for the act of using the vehicle; in addition to which this name is applicable to any kind or form of self-propelled vehicle."

Bishop Seymour of Springfield, Ill., suggests the word "autokineton," which, he says, is pure Greek. Other curious possibilities mentioned are "sponto," "ahippion," "mob," "dynamette," "machinette," "moteel" and "pou vehere."

Westinghouse Affairs in England.

The Westinghouse interests are expanding. A company was recently established in France, and it is now announced that another will commence operations in England, having works at Manchester. It is said that George Westinghouse will direct the enterprise, using American experts and American ideas with British capital and labor. Lord Kelvin is mentioned as the technical adviser of the new company. Like the French company, the English concern will probably be entirely independent of the Westinghouse Electric and Manufacturing company of Pittsburg, although sustaining intimate and friendly relations with it.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

Chicago Exposition of Electrical Arts, Tattersall's, September 25th to October 9th.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th [illegible].

A comprehensive extract from Mr. F. J. Sprague's recent Institute paper on multiple-unit electric railways is given in this issue. The inventor's description of this important improvement in electric railroading is of exceptional interest, and deserves a careful perusal.

One explanation of a recent fire in the infants' ward at Bellevue Hospital, New York, was that in some way "the candle was upset." Now people are wondering why electric lights are not provided in such an important institution as Bellevue Hospital. Portable lamps are easily arranged, and the use of candles in a place where a fire would be such a serious matter seems to be without excuse.

Although the electric vehicle has scarcely been introduced into public use, its "dangers" are already subjects of discussion in the daily newspapers. Incompetent and reckless operators have given ground for public alarm, and failure of the controlling devices to work properly has increased the distrust which many had felt toward the innovation. It will not allay public fears to point to the number of accidents that are due to runaway horses. The street-railway men of the country will appreciate this fact and they will recall the opposition to the "deadly" trolley that was developed in this country only a few years ago. It is true that public sentiment has changed, but many enterprises suffered in the meantime. When a little attention will avert trouble it seems that the promoters of automobile companies would do well to avoid the dangers that the trolley men encountered. This is the critical time, and by exercising great care and intelligence the promoters of these new enterprises will save themselves lots of trouble in the future.

An interesting feature of the electrical display in connection with the National Export Exposition in Philadelphia next fall will be the plan of special illumination of the city hall adopted for the period of the exhibition. The building is a very imposing structure, the highest point being 547 feet above the ground, and at present there is a rim of lights around the base of the statue of William Penn, which surmounts the structure. It is claimed that these lights can be seen at a distance of 30 miles. Before the exposition opens a ring of arc lights will be placed around the rim of Penn's hat, over 500 feet above the pavement, and long strings of incandescent lights will run from there to the roof of the building. Every cornice will be studded with lights, and all sides of the massive building will be emblazoned by designs in colored lights. Much interest will be manifested in the effect thus produced. It has been the experience of managers of expositions that the arc and incandescent lights do not harmonize when used for display purposes. The arc lamp is too harsh to produce pleasing effects, and the incandescent dwindles into insignificance when placed in contrast with the more powerful illuminant.

In a recent address to employes of the Metropolitan Street Railway company of New York, Mr. H. H. Vreeland, the president, is reported to have said to his men that he was surprised that there should be dissatisfaction among them, as there was only one railroad company in the country that was paying the wages of the Metropolitan company for electrical service, and that was in Boston. "There is trouble across the river," said he [referring to the Brooklyn strike], "about trying to get $2 a day. Over in Jersey the average is $1.80; in Philadelphia they are paying cheaper wages than we are here." The Metropolitan company pays its men on electric cars a maximum wage of $2.25 a day. Mr. Vreeland seems to forget that several companies in the West pay an equal or greater rate. On the Chicago and Evanston line the rate is $2.25 a day; on the La Grange Suburban road 22½ cents an hour, and on the Chicago City lines the pay is 21 cents an hour, which is $2.10 to $2.52 a day. These are for the men on the electric cars. On the cable roads the Chicago City Railway company pays the highest street-car wage in the country—29 cents an hour. The West Chicago company pays 23 cents an hour and the North Chicago $2.25 a day. In the East the wages vary from the high rate of the Boston company, referred to by Mr. Vreeland—$2.25 for 10 hours—to the low one in Philadelphia, 16⅔ cents an hour.

Some of the daily newspapers are discussing at considerable length the propriety and desirability of funerals on trolley cars. This newspaper talk is rather late in the day, inasmuch as funerals of this character have been conducted for several years. The special car used for funerals by the Chicago Electric Traction company was described and illustrated in the Western Electrician of March 12, 1898, and long before that the Calumet Electric Street Railway company had carried "trolley funerals," as they have been called. Four outlying cemeteries are on the lines of the Chicago Electric Traction company's storage-battery road, and the transportation of funeral parties followed naturally and almost inevitably. In Chicago and other large cities a large proportion of the funerals are by train on the steam railroads. It is difficult to see why the substitution of electric motors for steam locomotives in moving the trains should introduce any incongruous or discordant element in the sad procession to the burying-ground. The poor receive the benefit of a lightening of the heavy funeral charges with no loss of respect to the honored dead.

One point in Mr. Fisher's paper on "Operation and Maintenance," read before the recent convention of the Independent Telephone association, deserves the especial attention of the independent telephone manager. In effect, Mr. Fisher says: Charge reasonable, just, fair prices for your service; not ruinously low prices; else you will come to grief. This is excellent advice. It does not mean telephone-monopoly prices, by any means, but it means the rate, in each community, which will return a fair profit on actual investment when the business is extended to the limit that may be fairly apprehended. Careful examination and calculation in each instance should determine what the probable growth of the business will be. The investor should ascertain, as closely as possible, what the ultimate cost of his plant, with first-class construction, will be. This figure may be very different from the initial cost. With this cost basis, figure out the rates on the assumed maximum service and apply these rates from the start.

We published Mr. Fisher's paper last week, but on this vital point we may repeat his language:

It is true in the telephone business, as it is not true in most other business, that the larger the business the greater the expense pro rata and per capita for operation and maintenance, as well as for construction; where, in a plant of 1,000 telephones, a rate of, say, $20 to $30 may be fairly successful, in doubling the plant, it will materially increase cost of building and compel a still greater increase per telephone in operating. I am of the opinion that we need, as well as the public, more information than we have yet secured in this branch, in accepting franchises or ordinances, in the larger cities of the country which are now being developed. We should not be so eager to try to secure them as to entail perhaps a serious burden upon the future of the business in the smallness of the maximum of prices permitted to be charged. We all know that the old company has exacted an undue profit. At the same time, it would be most unfortunate if the independents should establish a scale of rates for service that would not permit first-class service and a reasonable return upon the investment required for such service.

A case in point is that of the People's Telephone company of Jackson, Miss. On another page a correspondent tells the reason of the absorption of this company by the Bell company of that district. Rates too low and construction not up to the standard—such is the story in brief. It was much the same with the Citizens' Telephone company of Crystal Springs, Miss., which has likewise gone the way of absorbed telephone companies. The warning is clear and should be heeded. Put in more money at the start; calculate the expense on a basis allowing for reasonable growth; employ none but first-class construction.

Henry Hine, General Manager of the Stanley and Sprague Electric Companies.

The rumor in Wall street last week that the Stanley Electric Manufacturing company of Pittsfield, Mass., had been disposed of to a "New York syndicate," with the price for the Stanley stock placed at $150 a share, and the additional item of news that Mr. Henry Hine, manager of the Stanley Electric Manufacturing company, had been paid the high compliment of having been appointed the new general manager of the Sprague Electric company, at the same time retaining the managership of the Stanley company, is found to be correct. The Western Electrician secured the following statement of facts, authorized by Mr. Hine:

"A controlling interest in the Stanley Electric Manufacturing company has been sold to a New York syndicate. The price to be paid for the stock is $150 a share. Fifteen per cent. has been paid in cash, and the balance is to be paid within 90 days from the date of the signing of the agreement. The rumor of consolidation, which is without foundation, is doubtless due to the fact that the new general manager of the Sprague company still retains the managership of the Stanley company, and also to the fact that some of the stockholders interested in the Sprague company are also interested in the recent purchase of the Stanley company."

The entire new list of the Sprague company's officers is named as follows:

President—A. B. Chandler.
First vice-president—John E. Searles.
Second vice-president—Frank J. Sprague.
General manager—Henry Hine.

Mr. Chandler is president of the Postal Telegraph-cable company and Mr. Searles, as is equally well known, was formerly a prominent officer of the American Sugar Refining company.

It is rumored, also, that other important electrical companies, manufacturers of direct-current apparatus, have been approached with the idea of coming under the control of the interests that are now dominant in the Sprague and Stanley companies.

In view of the importance and responsibility of the office thus assumed by Mr. Hine, and with a knowledge of the general interest among electrical people in the changes that have occurred in two such important and influential companies, a word relative to the career of the new general manager will be timely:

Mr. Henry Hine's record in the electrical business dates back quite a number of years. It was about 1877 that he entered the office of Leonard E. Curtis of New York, a well-known patent attorney, with a view, perhaps, of fitting himself for the career of a patent lawyer. Electrical commercial life, however, proved too alluring, and under tempting inducements he became New York manager for the old United States company. When, however, this concern was bought by the Westinghouse interests Mr. Hine was again made a New York manager.

It was in 1890 that he undertook the managership of the Stanley Electric Manufacturing company, and the present remarkably successful position in the electrical business of this concern stands as a monument to Mr. Hine's executive and technical ability.

The Stanley company was first started in 1890, occupying one floor, employing 16 men, with a capital of $25,000. The present authorized capital is $500,000, with $413,000 subscribed. The first shipment was made in April, 1891. To-day the force of employes numbers anywhere from 250 to 300 men, who receive in the neighborhood of $3,000 a week in wages. Since the company started it has been called upon to compete with all the great companies of the country, but has built up a business of over $600,000 per annum. In the shops now is $300,000 worth of work, and it is interesting to chronicle that the stockholders have been paid over 40 per cent. in dividends in the last eight years, and for every $100 they put in originally they now get $150.

The fact that it was only five years ago that the Stanley alternating generators were first brought out and the further fact that the company has for years run practically 24 hours a day form another tribute to Mr. Hine's ability and good judgment. It must be remembered, too, that the stock of the Stanley company was held for the most part by Pittsfield people, and has heretofore changed hands back and forth in a small way for about $130 a share. At the recent sale to the New York people the price paid was $150—another indication of the value of a property which owes its success so largely to the subject of this sketch.

The Dubuque Daily Times of July 15th states that there is to be a reorganization of the Dubuque Street Railway company and that the controlling interest in the line will pass from the Rhomberg estate into the hands of Bart E. Linehan and William S. Molo, owners of the Star Electric company.

The Volta Centenary.[1]

The celebrations in honor of the centenary of the discovery of the Voltaic pile at Como, which have just terminated, were conducted on a much more gigantic scale than had been anticipated by those who had the good fortune to participate in them. They extended over a period of three weeks, four days of which were spent at Como and three at Milan. The delegates were afterward entertained at Bologna for a couple of days, and a similar period at Florence, from which they proceeded to Rome, nearly a week being the extent of their sojourn in the Eternal City. Some of them pursued their travels still further, a French contingent going on to Naples, while others made their return route via Venice and Verona. The majority, however, traveled by Pisa and Genoa to Milan, whence they took divers courses toward their respective homes.

The importance of the event would appear to have been appreciably realized by most countries, and the delegates generally were thoroughly representative of the telegraphic and electrical professions. It was, however, a peculiarly significant sign of the times, and indicative of the condition of the countries, that neither Russia nor China was represented, and none less regrettably suggestive was the fact that while Germany and France had each a worthy delegation of between 40 and 50 members, many of whom were among the foremost electrical authorities of the day.

HENRY HINE.

Great Britain had only a paltry half-dozen! The recognition which the British postal authorities extended to the celebrations simply amounted to the granting of special leave of absence for a fortnight to six representatives for the purpose of attending these functions, and as showing the acumen displayed in the selection of the six men from the list of applicants it may be pointed out that only four of them deemed it worthy to take advantage of the facilities offered. In striking contrast to this lethargic indifference on the part of the British telegraphic service was the action of other countries. The Italian representatives were afforded permission to travel all over their railway systems, to the scenes of the celebrations, while similar privileges were granted to the French and German congressists, and, indeed, France had arranged to allow the British delegates free traveling to the Italian frontier, but from some unknown reason this information was not communicated to them until after their arrival at Milan. Far-away Japan had a distinguished representative in Mr. Tamaki, M. E., the engineer to the Imperial Department of Communications at Tokyo, and America was worthily represented by Mr. Walter Burton. Roumania sent M. Arsenescu, the chief telegraph engineer, from Bucharest, and the Argentine Republic had her delegate in Mr. Nicolson, from Buenos Ayres. Cavalier Cacopardo, the provincial director of posts and telegraphs at Messina, was the congressist from Sicily, while France had, besides the controller of telegraphs and the editor of the leading telegraph journal in France, an illustrious representative in M. Baudot, the inventor of the telegraph instrument which bears his name, and M. Assant, interpreter to the minister of posts and telegraphs at Paris. Austria was well represented, and Hungary had, besides her male complement, two lady delegates, the only other country recognizing the sex being Italy herself.

The celebrations took the form, chiefly, of an electrical exhibition and a display of Volta's instruments at Como, a congress of telegraphists and of electricians, a ceremony at the statue of Volta at Como and at his tomb at Camnago, and similar ceremonies at the statue and tomb of Galvani at Bologna. The chief orations at Volta's statue, where a bronze crown, subscribed for by the telegraphists of all nations, was unveiled, were delivered by M. Baudot and the syndic of Como, who each gave eloquent expression to the importance and value of Volta's discovery. The congressists, who had assembled on the grand stand, immediately afterward formed into a procession, and while the town band played the various national anthems, they marched solemnly around the statue with their heads uncovered. Next morning at six o'clock the company drove to Camnago, a distance of four kilometers from Como, to the tomb of the great physicist, where a beautiful marble slab, with an oxidized silver wreath on its surface, was deposited at the entrance by the French delegation, and numerous floral decorations were contributed by the delegates from other countries. Orations were again delivered, and after signing their names in the visitors' book, the company were entertained at the house of the mayor of Como. Afterward they visited the Camnago Orphanage, an imposing structure on the side of one of those hills for which Como and its lakes are famous. They were then shown over all the establishment, and afterward entertained at breakfast in the large hall. During their visit to Como the delegates were made the recipients of all manner of kindness. On the evening of their arrival they were entertained at dinner in the grand saloon of the Hotel Phinius, by the organizing committe, at which the minister of posts and telegraphs presided. The exhibition gardens, the lake and the town were afterward illuminated on a magnificent scale in honor of the strangers. Next evening an operatic representation of "Othello" was provided for them in the Social Theater, for which the famous orchestra from the still more famous La Scala Theater at Milan was engaged. A reception in the town hall by the Civil Servants was the programme for the third evening, but the final day's experience at Como was the richest of all. It took the form of an excursion on the lake, in a special steamboat provided by the municipality of Como. Their destination was Belaggio, situated about 15 miles from Como, on the promontory which divides the lake into two branches at that point. Dinner was served in the Grand Hotel, at which the mayor of Como was chairman, the company afterward returning by steamboat to Como, after a memorable day's enjoyment amid, perhaps, the finest scenery in all Europe. A farewell visit was paid to the syndic or mayor of Como, at the town hall, before departing for Milan, and grateful acknowledgments were paid for the munificence and spontaneity of the generosity extended toward the delegates.

1. From the London Electrician. Since this account of the celebration was written the Como exhibition has been destroyed by fire.

Staff Changes.

On July 15th Mr. John B. O'Hara retired from a connection with the Western Electrician that had existed since December 15, 1888. Mr. O'Hara had been in charge of the editorial department of this journal since March 1, 1891, and had been managing editor for over six years. During this long period of service Mr. O'Hara won the hearty esteem not only of his associates but of a large circle of friends throughout the electrical fraternity. His work on the Western Electrician was of a high order, and it was recognized and appreciated. Mr. O'Hara retired to become manager of Modern Machinery, a Chicago monthly of wide circulation, and the admirers of his ability and character, among whom his late associates of the Western Electrician number themselves among the first, hope that he will meet the most abundant measure of success.

On Saturday afternoon Mr. and Mrs. O'Hara were the guests of honor at a country-house party given by Mr. and Mrs. W. A. Kreidler at their place in Lake Bluff on the North Shore. The occasion was marked by the attendance of present and former members of the Western Electrician staff and by the presentation of some books to Mr. O'Hara.

Mr. W. E. Keily, for eight years an associate editor of the Western Electrician, succeeds to the position of managing editor. He will be assisted by Mr. C. W. Whitney, a recent graduate of the engineering department of the University of Michigan. Mr. Charles S. Clarke, of the business department, is likewise a late addition to the staff of the Western Electrician.

DEVELOPMENT OF THE TELEPHONE FIELD.

Development of the Independent Telephone Business.[1]

By H. D. Critchfield.

Part I.

Ten days ago I was asked to occupy not to exceed 20 minutes of your time. In that time I have been requested to prepare an address, detailing the development of the independent telephone movement in the United States. I consented to do the best I could under the circumstances. I knew the difficulty of the task, and how entirely inadequate a discussion of that subject must be under the circumstances.

Those of us present who have had occasion to try and get an accurate idea of the situation in our respective states even, have found it almost impossible to keep pace with the development among our neighbors and personal friends.

As attorney for the United States Telephone company of Cleveland, O., which is building first-class long-distance toll lines to connect all of the independent telephone exchanges in Ohio, I have had occasion during the last few months to try to ascertain the statistics relating to the independent exchanges and toll-line systems built and building in my own state. It has been almost impossible to get them, even with most careful observation. Exchanges are built and put into operation in small towns and connected with the outside world before their neighbors in adjacent counties are aware of the fact. Toll lines are building, and, like the Kansas pumpkin vine, in one night grow so far that the end cannot be found the next day. From this experience and considering the shortness of the time allowed for the preparation of this paper, I know that anything like an attempt to secure statistical information would be utterly useless, and, necessarily, a failure. Therefore, what I may say on the subject of development will necessarily be fragmentary and of a general character, and contain a suggestion as to the wisdom of attempting to secure, through the influence of this association and the records which it may establish, more complete and accurate information for the future.

Those intimately connected with the independent telephone movement, who read the electrical journals and newspapers generally, get some glimpse of the development of the independent telephone business from paragraphs of items like the following:

The Massachusetts Telephone and Telegraph company began the construction of its telephone system in Boston on the 6th inst., and the laying of conduits is the first work undertaken; as soon as these are finished the overhead lines will be taken in hand. The company has secured up to date about 4,000 subscribers in Boston.

Grand Rapids, Mich.—The Citizens' Telephone company has increased its capital stock from $200,000 to $300,000.

The Indianapolis Journal states that the New Telephone company has completed arrangements for a western wire as far as St. Louis and ultimately Kansas City.

The Citizens' Telephone company, Houston, Texas, to operate a telephone system in Houston, has been incorporated with a capital stock of $100,000.

The Home Telephone and Telegraph company of Lawrence, Mass., has been incorporated with a capital stock of $100,000.

The Mississippi Valley Telephone company will have its Minneapolis exchange in operation by the 1st of June, and the first thousand telephones will be connected by that time.

Lowell, Mass.—The Home Telephone and Telegraph company has recently been incorporated.

Binghamton, N. Y.—The Binghamton Telephone company of this city has been incorporated to operate in Broome, Tioga, Chenango and Delaware counties. The capital stock is $100,000.

Macomb City, Miss.—The Pike County Telephone company has been incorporated with a capital stock of $25,000

Kossuth, Ia.—The Kossuth Telephone company has been incorporated with a capital stock of $25,000; principal place of business Germania, Ia

The Street and Water Board of Jersey City has passed the ordinance granting a franchise to the Hudson Telephone company over Mayor Hoos' veto.

The Virginia and Tennessee Telephone company, Pulaski, Va., has been incorporated with a capital stock of $300,000.

The Dahlonega Telephone company has just been organized at Dahlonega, Ga.

Perhaps the articles are a little longer, and read like the following, from the Indianapolis Sentinel, in a discussion of the efforts of the Central Union Telephone company to place its new mortgage loan of $6,000,000, in which it says:

The new Central Union mortgage shows the company to be the owner of 41 exchanges in Indiana. There are now more than 150 independent exchanges; practically every city and town in the state has an independent company that is getting about all the money that is paid for telephones. They are all doing remarkably well and all paying dividends. They do not cut rates below the fair price at which they started and are not expected to. There are 2½ miles of independent toll lines in Indiana for every mile of Central Union. The capitalists have been attracted to the business and are investing for us and it is safe to say that no amount of money spent by the Bell company can, even in the slightest degree, check the onward movement of the company.

The New York Sun published an article in which the growth of the telephone business in this country, since 1884, was shown in figures given by the reports of the Bell company. The article concludes as follows:

It must be remembered that the independent telephone movement, which has been growing rapidly from the expiration of the fundamental Bell patent six years ago, has assumed important proportions, and that its promoters and supporters have established in the neighborhood of 3,000 exchanges throughout the country. Naturally, many of these are in small places where the Bell company's rates have proved an insurmountable barrier, but others are in towns where exchanges have been in operation. The low rates of the anti-Bell companies have greatly stimulated the business and placed the service within the reach of many who could not afford Bell prices. In spite of the reduction of prices the character of the service has been improved, as competition has made it necessary for the Bell company to use inventions and improvements that otherwise would have been buried.

This was the policy of the Bell management during the period when it enjoyed a monopoly, but this course had to be abandoned as soon as the independent movement got thoroughly under way.

Items and extracts like the foregoing might be multiplied almost indefinitely, and yet they scarcely give an adequate conception of the marvelous development of the independent telephone movement and business in our country.

It is altogether probable that the statement credited to the New York Sun is not too high. It is corroborated by the information given by the Indianapolis Sentinel, that there are more than 150 independent exchanges in the Hoosier State. There are about the same number in Ohio, and some 50 more exchanges in that state are now in different stages of promotion and completion. It is certain that pretty much every city and town in the Buckeye state will have an independent telephone exchange, with ample long-distance connections, within the ensuing year. The Bell company in Ohio, represented by about a half-dozen subordinate or licensee companies, has not 100 exchanges in that state.

The independents, where they have completed exchanges in Ohio, are operating more than 21,000 telephones, as compared with but little more than 4,000 used by the Bell company and its licensees in the same towns and counties, and their toll service is almost proportionately larger than the Bell company's.

Doubtless, in your interchange of information with each other, you have secured similar facts as to the other states represented in this convention. We know that already, in quite a number of states of the Union, the independents have thousands more telephones in service than the Bell company in the same territory, and this condition exists notwithstanding the fact that the old company has been in operation more than 20 years, while the oldest independent exchange in the country has not been in existence five years, and this, too, in the face of the financial depression from which the country suffered about the time of the expiration of the fundamental Bell patents.

This growth has come, notwithstanding the claims of the opposition company that the independents could not make good telephones and switchboards and could not operate them successfully, even if they had first-class apparatus. These claims of the opposition company have been proven untrue. There are to-day in this country, as you all know, many manufacturing concerns turning out apparatus for the independent telephone users which is equal, in every respect, with that turned out by the manufacturers for the American Bell. No better evidence of this fact is needed than is shown by the figures of the number of telephones used by the old and new companies in the same territory.

It has been my good fortune within the last few days to visit St. Louis and Indianapolis, and, at a more remote period, Detroit, Grand Rapids, Knoxville, Sioux City, Fort Wayne, Sandusky and numerous other large cities in which independent telephone exchanges are now in successful operation in competition with the Bell company. In every single instance the independents have more telephones than the old company, and in a number of them three times as many. These exchanges represent the apparatus of many different manufacturers, and are working against the most severe and active competition. In every single instance, from my personal observation, these exchanges are giving most satisfactory service, and in one of the cities referred to the largest single switchboard now in operation in the United States is daily answering more calls per drop than any switchboard in North America.

The tendency has been toward cheaper service and better construction. This tendency toward cheaper service has gone far enough, and care should be taken that rates are not fixed so low that the plant cannot be maintained in first-class condition from its earnings, in addition to a reasonable profit, through all the future years. The cities and towns above specifically referred to are but a drop in the bucket, and the different manufacturers of independent telephones each have their apparatus in successful operation in hundreds of towns and cities other than those above mentioned.

1. Read before the Independent Telephone association, Chicago, June 27, 1899.

Telephone War in New Jersey.

There is every prospect of a telephone war in Bound Brook, N. J., between the Home Telephone company, a local corporation, and the New York and New Jersey Telephone company. The latter company has had three telephones in Bound Brook for a long time. Two years ago the Home company secured a franchise and established a local exchange. The New York and New Jersey company has now stretched a cable from its main trunk line along the tracks of the Jersey Central railroad to Manning's drug store, its local exchange. It is now installing telephones wherever they are ordered. No permission was granted to the company to string the cable. Heretofore, the borough officials have refused to grant the New York and New Jersey company any rights, and are now watching carefully to see if the company goes any further in its work. The company defends its action in stringing the cable by stating that it has a perfect right to do so as long as the supports or wires are not on the highways.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A telephone line is being constructed between Audubon, Ia., and Manning.

The Northeastern Minnesota Telephone company has connected with Princeton, Minn. A local exchange will be put in.

The Montour (Ia.) Telephone company has completed arrangements to connect with the Le Grand, Ia., line.

James Hayden proposes to establish a local telephone exchange in Madison, Minn.

The Northwestern Telephone Exchange company will establish an exchange for long-distance telephones in the midway district, between Minneapolis and St. Paul. Calls will be made without having to call through the city boards.

A recent order of the Iowa Telephone company in Northwestern Iowa forbids "deadhead" messages between operators on the toll lines, and will not allow checking up of one town with another. Many of the local operators are understood to object, and some have ordered the telephones removed from their places of business.

The Jefferson County Telephone company of Jefferson, Wis., has called in 50 per cent. of its capital stock.

Lightning struck the telephone exchange building in New Ulm, Minn., and cut off all communication.

The Northwestern Telephone Exchange company has made a lower toll-rate between Minneapolis and the Red River Valley, based on a one-minute service. The old rate was based on three-minute service. Additional wires will be strung to relieve the pressure of business on the wires now in service.

The Wisconsin Telephone company will erect an exchange and office building at La Crosse, Wis.

The Northwestern Telephone Exchange company will erect a two-story fireproof exchange and office building at Fargo, N. D. A similar building will be erected at Grand Forks, N. D.

The Central Telephone company has completed a telephone exchange at Pella, Ia., and is preparing to begin similar work at Newton and Grinnell, Ia.

The Rocky Mountain Bell Telephone company is preparing to extend its system in Montana, to connect with the telephone system in the Yellowstone National Park, at a cost of about $10,000. It is intended to have it completed this season.

The Forman (N. D.) Telephone company has raised its rates to $2 a month, and its patrons are displeased thereat.

The Marshfield (Wis.) Telephone company is considering a proposition to join the telephone company at Grand Rapids, Wis., in constructing a toll line connecting the two systems.

The Zenith Telephone company of Duluth, Minn., has made the County Board an offer to put in as many telephones as the Duluth Telephone company at $225 a year, the money to be paid to a trustee, to go to the company at the end of the year having the larger number of paying subscribers.

The Wood County Telephone company of Centralia, Wis., reduced telephone rentals 25 per cent.

The Wisconsin Telephone company is putting in a new line between Oconto, Wis., and Stevens Point.

The city engineer has stopped the Northwestern Telephone Exchange company from rebuilding its pole systems in Minneapolis. The company has the right to replace poles without permission, but cannot make repairs and changes, and this seems to be what has been done. The city engineer has a plan which he thinks would solve the difficulty of underground wires. He would divide the lines into mains and distributing leads. The former would include more than 30 pairs of wires, or more than five cross-arms to carry the wires. A distributing lead would include all leads of smaller dimensions. The main leads would have to go underground, but the others could be maintained on poles. He thinks the companies would find it satisfactory, for it would do away with laying a conduit for two or three pairs of wires. Underground wires are said to be cheaper in the end than pole construction for heavy leads, as they do not require repairs after the line is completed.

The local telephone exchange at Aitkin, Minn., is completed and in operation.

The People's Telephone company has started work on its new exchange in Superior, Wis. It is to be done in September.

The rival telephone companies in Duluth, Minn., are in dispute. The old company objects to the new company stringing its wires near the former's, saying the new wires would be impaired.

G. D. Dunlevy and other citizens of Fosston, Minn., propose to form a local exchange company and put in a system.

The Southwestern Minnesota Telephone company has been granted a franchise at Slayton, Minn.

The differences between the Inland Telephone and Telegraph company and the Spokane and British Columbia Telephone company at Spokane, Wash., when the latter's wires into Spokane were cut, have resulted in a suit being brought for $205,000 damages. Three causes are alleged: First, the defendant company broke its agreement; second, that it cut the plaintiff's wires, and third, that unless

further restrained, it will still further damage plaintiff's property. The Spokane and British Columbia company announces that it will parallel every toll line of the Inland company, and will apply for a franchise and put in another exchange at Spokane at a cost of $300,000. The old company claims that it is preparing to put in a new and modern system, which will be thoroughly satisfactory, and if a second company is admitted to the field, it will be to the subsequent sorrow of the city, and will require every business man to have two telephones, at an increased expense.

The Minnesota Central Telephone company will extend a toll line to Starbuck, Minn.

The Black Hills Telephone company is putting in a switchboard for the new exchange at Spearfish, S. D., and will soon have the instruments in.

A curious Minneapolis man who had a Northwestern telephone in his place of business got tired of waiting for the Mississippi Valley instrument to be connected, detached the former and attached the wires to the latter. The instrument worked well, and others followed his example, but the Northwestern company disapproved and took out their instruments and wires from every offending place. The Mississippi Valley company expects to have its switchboard in place in a short time now.

The Western Electric Telephone company has filed a mortgage at Mason City, Ia., securing its bonds of $30,000.

Swan Kelley of Atlantic, Ia., succeeds O. M. Rudy as manager of the telephone exchange in Creston, Ia.

The Iowa Telephone company has completed its long-distance wires as far as Fairfield, Ia., and is pushing on to Ottumwa. There will be a copper circuit for through traffic and another for local business

The Sunset Telephone company proposes to connect with the Nooksack Valley at Deming, Wash., and beyond.

Storm Lake, Ia., will vote on granting a franchise for a local exchange to the Iowa and Nebraska Telephone company.

The Bellevue Telephone company has been incorporated at Bellevue, Ia., with $10,000 capital stock. It proposes to establish an exchange at Bellevue and connections with the other towns in the vicinity.

John Nicholson, a lineman employed by the Northwestern Telephone Exchange company, St. Paul, fell from a pole and received injuries from which he died shortly after. A feed wire of the street-railway company touched an iron step on the pole, and the action of the wind had worn the insulation off. When Nicholson stepped on the iron step he received a current of 480 volts, which caused him to loosen his hold and fall.

The telephone line between Mount Pleasant, Ia., and Hillsboro has been completed and put in operation.

The telegraph wires of the Burlington railway between Clarinda, Ia., and Page Center have telephones connected and telephone communication is possible at the same time that telegraphy is going on.

A chess match has been progressing by telephone between Davenport, Ia., and Clinton, Ia.

A telephone line is projected from Belle Plaine, Ia., to Irving.

The Northern Telephone company has been incorporated at Fonda, Ia.

The Little Wolf River Telephone company has secured control of 100 miles of toll lines owned by the Northwestern Telephone company of Green Bay, Wis.

The Northwestern Telephone Exchange company has been working to overcome induction ever since the street-railway company put in its lower dam power house at Minneapolis. At times the induction has been simply fatal to the telephone as a useful instrument. But the company thinks the cure has been discovered and hopes to have no further trouble.

L. B. Rowe of Sioux City, Ia., proposes a long-distance telephone system to connect Yankton, S. D., with Armour, Edgerton, Wheeler and other points in South Dakota and with Hartington, St. Helena and Ponca, Neb.

A telephone exchange will be installed at Montevideo, Minn., at once.

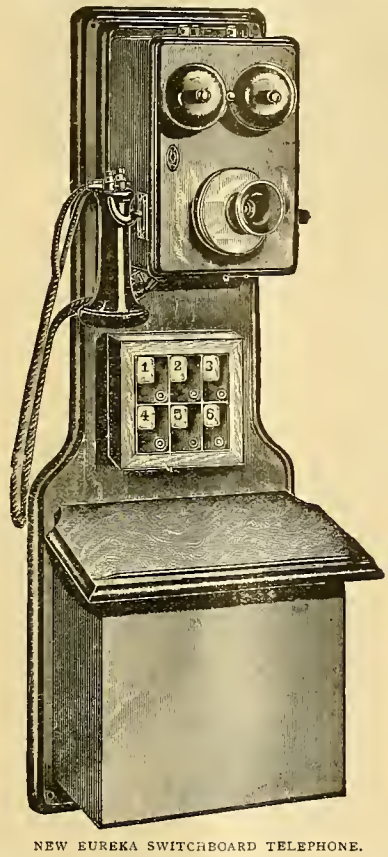
Johnson Brothers have been granted a franchise for a telephone exchange in Armour, S. D. A similar franchise was granted last October to Rowe Brothers, conditional on the exchange being in operation by January 1, 1899. Rowe Brothers sold out to E. C. Ward of Armour, who put in four or five local telephones. The town officials do not consider this complying with the terms of the franchise, and declared it forfeited.

L. S. Tainter, the principal owner of the Wisconsin Valley Telephone company's toll lines and exchanges in Chippewa Falls, Eau Claire and Menomonie, Wis., announces that the system has been sold to the Wisconsin Telephone company and will be turned over within a short time. Mr. Tainter says the expenses of operating the line are heavier than the promoters claimed and it has been a losing venture. About February 1st Mr. Tainter notified all stockholders that anyone who felt dissatisfied might sell the stock to him. It resulted in his getting nearly all the stock. He says he feels glad that he has protected the small stockholders, who might have invested through his connection.

Mississippi Independents Sell Out to the Bell.

A Mississippi correspondent sends news of the defection of the People's Telephone company of Jackson and the Citizens' Telephone company of Crystal Springs and Vicksburg in that state. He gives the reasons why these companies sold out to the Bell people, and shows the vital need of establishing fair rates, good line construction and toll-line connections. The lesson should be a valuable one. What follows is in the language of the correspondent:

The People's Telephone company of Jackson, Miss., having recently sold its exchange and connecting lines to the Cumberland Telephone and Telegraph company of Nashville, Tenn. (which operates throughout this and adjacent sections), transferred its exchange to the Cumberland company on July 6th. It may be of interest and, perhaps, value to the independent telephone fraternity to learn that this sale was practically forced by reason of two mistakes that are made by many independent telephone projectors: (1) The People's company cut the old Bell rates in half, which was too serious a cut, and made its rates lower than it could afford to make, and in consequence it neither realized any actual profit nor accumulated any reserve fund for rebuilding its plant when that became necessary: and (2) having begun with very limited resources and not having anticipated half the business it in time secured, its street construction was poor and



NEW EUREKA SWITCHBOARD TELEPHONE.

inadequate to carry the large business which came to it, so that when the electric railway and more extended electric-light service was put in at Jackson, Miss., the People's company was practically forced to the alternative of rebuilding the street work or else retiring from the field, and circumstances suggested the latter as the wiser course. It should be added that for a long time the People's company had a decided advantage over its strong competitor (the Bell company) as to the number of subscribers, but more than a year ago the Cumberland people put into effect a 50-cent residence rate which greatly increased the Cumberland list. Still, the People's list, though fewer in number, outclassed the Cumberland as to its commercial value, containing a much larger proportion of the better class of residences and business connections.

In Vicksburg and Crystal Springs the Citizens' Telephone company of the latter place operated, having at Vicksburg the largest independent telephone exchange in the state. This company has sold its entire outfit to the Cumberland Telephone and Telegraph company, making delivery of property July 7th. The Citizens' system was first-class in every respect and comparatively new, the oldest of its work being up but two years. It made the usual mistake of naming rates lower than it could afford to make—rates that yielded no actual profit and which would not have permitted the accumulation of a reserve fund with which to make the improvements and repairs which would in time have been required. The owners, finding by experience this to be true, and also finding it difficult to operate against the Cumberland 50-cent residence rate, which was established some 18 months ago, and also realizing that it would be ultimately at a disadvantage in the unequal contest with the Bell people by reason of the latter's long-distance service, concluded that their interest would be better served by selling out to the Cumberland company at a serious loss. Had its rates been remunerative and the independent lines throughout the adjoining territory been such as to give connection with the surrounding country, it would have been quite different, and the Citizens' company would doubtless have continued in business at both points. This sale to the Cumberland company, together with the latter's recent purchase of the opposition exchange at Jackson, Wesson, Canton and other points in Southern Mississippi, practically gives the Cumberland company entire control of the telephone business in Southern Mississippi, excepting Meridian, on the eastern edge, and a few smaller points.

Telephone Manufacturing in Japan.

Consul-general Gowey transmits from Yokohama, May 11, 1899, a clipping from the Japan Times containing interesting information relative to the telephone industry in Japan, as follows:

"The manufacture of telephone apparatus has so far advanced in Japan that, with the exception of springs, for the supply of which foreign aid is still depended upon, all other necessary paraphernalia can be made at home at about one-half the cost of foreign goods. At present, therefore, only a very small portion of telephone apparatus is being imported. Foreign instruments are used only in such places as Tokyo and Osaka, where the telephone connections are in brisk demand. Again, when the Communications Department is in need of a large supply for immediate use, it is obliged to patronize the foreign makers, it being not easy to procure the supply of Japanese instruments within a short time in any large quantity. The manufacture is carried on both at government and private shops, between which no particular difference is noticeable regarding workmanship. It is thought in some circles that, to encourage the development of the industry, the government shops ought to be closed and greater patronage accorded private enterprises. There are in Tokyo quite a number of such factories, of which only two or three are doing business on a large scale. There exist also a few in Osaka, as usual turning out a cheap and inferior quality."

The Telephone in Mexico.

According to a correspondent of Modern Mexico at Jalapa, that section of the southern republic is beginning to appreciate the advantages of telephonic communication. "The telephone line placing in communication the capital of the state with the port of Nautla on the north and the cities of Orizaba, Cordoba and Zongolica on the south, is just completed. The importance of this line, the total length of which is 250 kilometers, is great, considering that it reaches all the most important coffee districts of the country, and furnishes to the merchants many advantages in their transactions with those towns and farms that the line crosses. A large part of the material was furnished by the Southern Electrical Supply company of St. Louis, Mo. The National Telephone company, which owns the line, is trying to bring it as far as Vera Cruz, which will increase trade in general in that part of the republic. The companies furnishing the public and private lighting in the cities of Huatusco and Cordoba are considering a project to enlarge their water as well as their electric plants."

Southern Independent Telephone Association.

At the recent convention of the Southern Telephone association in Memphis the name was changed to one more distinctive of the aims of the organization—the Southern Independent Telephone association. These officers were elected: President, James D. Randall, Memphis; treasurer, George W. Scheuing, Memphis; secretary, G. W. Bolton, Pontotoc, Miss. A committee, consisting of Captain James D. Randall, T. D. Young and George W. Scheuing, was appointed to make arrangements for the independent telephone companies to enter Memphis. The association will hold its next annual meeting in Memphis next spring.

New Eureka Switchboard Telephone.

The accompanying cut illustrates the latest combined switchboard and telephone. This instrument has the great advantage to exchange managers of allowing them to install branch exchanges in small nearby towns, using one trunk line and connecting it to one of the drops of the switchboard.

This new instrument also allows an intercommunicating service in the small towns, and also a trunk line through the main exchange. It is designed to meet the requirements of the most exacting service, and will, no doubt, find ready sale. It is manufactured by the Eureka Electric company, Chicago, which will be pleased to give further information.

The Independent Telephone company has completed a toll line between Hampton and Belmond, Iowa.

New Leffel Engine.

The accompanying illustrations represent the new class "B," standard, center-crank, automatic cut-off engine put on the market by James Leffel & Co., Springfield, O. These engines are intended to meet the demand for a thoroughly good, simple and easily cared-for line of automatic engines in the smaller sizes, up to 50 horse power, that will prove

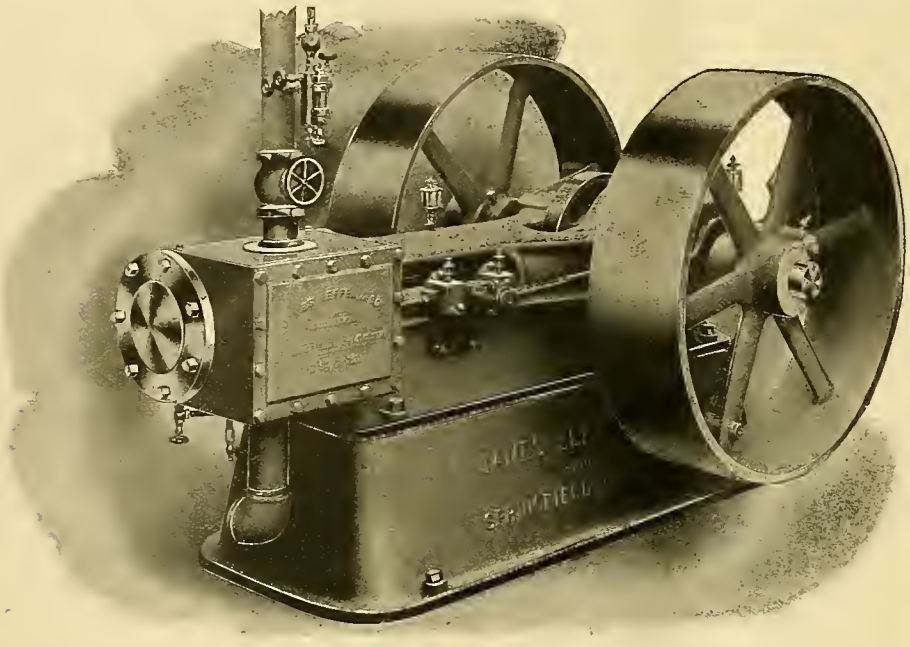


FIG. 1. NEW LEFFEL ENGINE.—STEAM-CHEST SIDE.

durable and economical in operation. Fig. 1 shows the engine from the steam-chest side and Fig. 2 illustrates the governor in the band flywheel.

The main frame or bed is of substantial proportions and of a design affording extra strength and stiffness. The cylinder and steam chest are of overhanging type, cast together and firmly bolted to the bed. The cross-head guides are a part of bed, bored out, and have very generous surfaces. The cross-head is of improved mechanical design, having pin about mid-center and provided with gun-

FIG. 2. NEW LEFFEL ENGINE.—GOVERNOR IN BAND FLYWHEEL.

metal wedge-shaped shoes above and below, arranged for convenient adjustment. The manner of fitting cross-head pin enables the latter to be kept absolutely tight at all times. The piston rod is of steel, and turned to a tight force fit in piston, with suitable shoulder, against which the piston is forced on the rod; the end of the latter is then securely riveted over, tightly and firmly holding piston in place.

The connecting rod is provided with extra heavy brass boxes at each end, easily adjustable for taking up wear and keeping distance between centers same at all times. The main shaft is extra large and strong, forged in one solid piece, from best quality hammered iron or steel, and is provided with suitable counter-balance disks, securely attached. The rectangular form of skeleton slide valve is used, balanced by being fitted with a pressure-relieving plate on back between valve and steam-chest lid, and is arranged to afford necessary relief in case of water in the cylinder, and also made adjustable for wear. This gives a simple, efficient and well-balanced valve, that is easily understood and no more trouble to care for than the ordinary type of plain slide valve. A simple and convenient device (not shown in cuts) is provided for draining the cylinder. It is operated by one lever and has outlet from each cylinder cock, suitably connected to exhaust pipe.

These engines are equipped with Rite's governing system, which is very simple. The governor (Fig. 2) consists of one piece, comprising the arms and weights, with one spring connection, and is pivoted on one hardened-steel pin. There is nothing complicated; no links, no numerous joints or complicated parts. This governor, with the balanced valve used, affords a regulation that is said to be practically perfect, the speed being constant with the engine loaded or running empty.

Rolfe Protectors.

The Rolfe Electric company of 355 Wells street, Chicago, is putting out a fine line of protectors for protecting telephone, telegraph, fire-alarm and similar instruments and circuits against the injurious effects of sneak currents, lightning and other high potentials, and power and lighting currents. The devices operate to open the circuit when any one of these objectionable influences intrudes upon it. They have demonstrated themselves to be equally effective, whether the cause which would produce trouble, if not checked, be a sneak current, a current from a power or lighting circuit or lightning or other high potential.

The protectors are built in a great variety of forms, to meet all possible conditions, circumstances and lines of service. These forms are for single lines, for the two sides of a single circuit, and for from 10 to 200 lines converging at any one locality. Of course, the last-mentioned style is intended for use principally at stations and exchanges. Most of the instruments are provided with an effective form of carbon lightning arrester. The bank instruments —the ones with protectors for from 10 to 200 lines— are usually made in the form of terminals, with arrangements for easily replacing any of the protectors, for testing the circuits, and so on.

In Fig. 1 is shown one of the instruments for the two sides of a single circuit, with a carbon lightning arrester combined with the protectors. Fig. 2 represents a 10-line terminal, designed especially for fire and police-telegraph service. Each line is provided with two protectors, one of which opens a two-inch gap at two amperes, while the other makes a three-quarter-inch opening at one-half an ampere. The instrument has carbon lightning arresters for all the lines, and extra terminals for testing, cross-connecting and so on.

The Rolfe protectors are the result of nine or 10 years' study and experiment in this field of work. They have been subjected to almost every conceivable test, and it is said that they have never failed to operate satisfactorily. Thousands of them are in actual service to-day in telephone exchanges, police and fire stations, and elsewhere. The National Board of Fire Underwriters has given them its indorsement.

The principal claims for these protectors are simplicity, reliability, accuracy, durability, cheapness, low resistance and an entire absence of magnets and like metal parts to be heated. The company has a comprehensive catalogue of its protectors, which is furnished upon application.

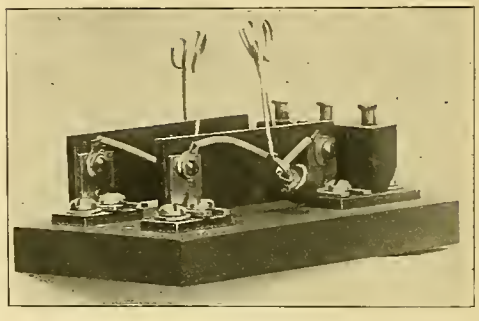


FIG. 1. ROLFE PROTECTORS.

FIG. 2. ROLFE PROTECTORS.

Mr. Sprague's Description of the Multiple-unit Electric-railway System.

[*Continued from page 47.*]

men in the fire room, and there was no straining of engines, dynamos or batteries.

As an example of extraordinary duty, the operation during the recent holidays may be cited. During a good portion of the time the central station is reported by the consulting engineers as operating as follows:

Fifty per cent. overload for six hours, full load for 17 hours and 74 per cent. load factor for 24 hours.

Out of 120 motor equipments designed for individual operation, 119 were in daily operation morning and night, with 28 or 29 trailers, thus overloading the station one-third, and often these trains coming out of the loop from two to five minutes late have made up time before reaching the end of the run, but naturally, of course, at a loss of efficiency.

The average duty of this equipment is higher than that of any other elevated railroad in the world. Cars have frequently made as high as 290 miles a day for days in succession, and the average maximum of cars in operation for long periods ran to nearly 100 per cent.

Troubles.

So much for the actual results accomplished on the South Side road. The question naturally arises, Have there not been difficulties, and if so, of what character?

Of course there have been, and I should have been

surprised, and almost sorry, if it had been otherwise, because it is only through the difficulties incident to the earlier operation of a system of this character that the essentials are fully determined and apparatus developed to a state of perfection.

It is curious, however, that there have been more troubles with what is classed as "standard apparatus" than with that individual to the multiple-unit control. These latter troubles were, first, with the rheostats, which were of new construction, and later, poor brush terminals, cracked gear cases, and with the earlier type of air governors.

With the specific multiple-unit apparatus the principal troubles were with poorly and hastily wound relay coils, too light and unsubstantial construction of auxiliary contacts and improper jumper construction, causing an occasional opening of the controlling circuits.

Taken all in all, however, the president and superintendent of the road state that there were less troubles than when starting with their compound locomotives, and on the whole the success of the road has been unparalleled in electric-railway history where so radical a departure has been taken.

CONCLUSION.

Coming to New York conditions I may say that, based upon the Chicago performance, and allowing for difference of coal cost, the Manhattan road, now operating at 12½ miles actual schedule during time of maximum load, and making about 43,000,000 miles annually, can be operated at over a 16-mile schedule at not exceeding nine cents, instead of 11.9, and on the existing mileage this would mean a saving, excluding interest on investment, of about $1,250,000 per annum, or allowing interest on investment of about $750,000, to say nothing of any other gains. A 17-mile schedule can actually be made with two motor equipments.

In closing, perhaps I may venture an opinion as to the general features which should characterize a suburban passenger railway equipment. I think it may be safely stated that the first is the use of the continuous current in the motor equipment, in spite of the claims which have been made and the results accomplished with alternating-current motors, at least so far as we can judge by any present developments.

The problem, then, is whence shall be derived this continuous current, and that depends upon distances. For moderate distances continuous-current generators supplying current directly to the line with or without the addition of storage batteries are preferable. When the extent of the line becomes at all serious, then it must be considered as made up of a number of shorter sections joined together, each of which derives its principal source of supply from a local station, which station can be driven directly by water or steam power, or by an alternating current from a distant station, using a motor-dynamo combined in a single type of machine, the rotary converter, or joined in the form of a directly coupled set, the dynamo end being for continuous current and the driver a synchronous or induction type of motor.

Generally the sub-station should be supplemented by a storage battery, to take care of fluctuations in the load, to make even the duty on the sub-station and, as far as possible, at the central station, and to take care of some portion of the peak-load caused by abnormal variations in the aggregate service at different times of the day.

Of course, with the storage battery comes the necessity of a means of some kind of automatic regulation; there are various methods, but I will not enter into them here.

Looking forward, however, to a perfectly assured future of a heavy service over considerable distances, I may state that the general equipment of such a road should generally involve the following essentials:

High-potential alternating-current transmission from one or two well-placed central stations, with or without static transformers.

Motor-dynamo sets or rotary converters at a number of conveniently placed sub-stations, to convert high-pressure currents into continuous currents of about 600 volts pressure.

Storage batteries of quick charge and discharge capacity at the same sub-stations as the motor converters, to equalize their duty and to prevent sharp variations in the generating plant as well as the sub-station.

A system of feeders and main conductors.

A power rail or trolley wire supplying continuous current, but ordinarily without any switching of currents.

Individual transportation units with a multiple-unit control, so that combinations of cars without regard to sequence or end relation can be made up at any portion of the line independently and controlled from any selected point.

Second Street-car Strike in Cleveland.

It is only about a month ago that a settlement was reached in the strike on the "Big Consolidated" street-railway system in Cleveland, yet the entire system was again "tied up" on Monday morning last. The men claim that their employers have refused to live up to the agreement entered into at the time of the settlement of the recent strike, and they refuse to work. There were scenes of violence on Monday, but no one was seriously hurt. It is alleged that the second strike was not inaugurated until assurances were had from the employes of the "Little Consolidated" line that they would go out in the event there was danger of the strikers losing their cause, thus effectually "tying up" the street-railway service of the whole city.

Large Electric Dry-dock Plant.

Washington, July 15.—During the last session of Congress an appropriation of $1,100,000 was made for the construction of a granite dry dock at the Portsmouth, N. H., navy yard. This money is now available and the Navy Department is now inviting sealed proposals for the work. They will be opened on August 26th and the contract awarded as soon thereafter as possible.

In the equipment and operation of this dry dock, which will be one of the finest in the world, electricity will play a very important part. There will be six 150-kilowatt dynamos of the compound-wound, direct-current, constant-potential, 125-volt type, aranged for direct connection, with outboard bearings. They must be capable of running for a period of 12 hours on full load without producing a rise of temperature of more than 35° C. in the armature or field coils, or more than 45° C. in the commutator. Three 300-kilowatt motors, each connected to the shaft of a main pump, and one 50-kilowatt motor, connected to the shaft of a drainage pump, will also be provided. These motors will be wound for 220 volts. The six 150-kilowatt dynamos will be connected to the switchboard by heavy rubber-insulated cables, covered with a wrapping of jute as a protection in drawing in. The switchboard will have one panel for each dynamo, one total-output panel and four power panels. Each dynamo panel will have one triple-pole, single-throw switch, with fuse connections on the back of the board, one field rheostat, mounted on the back of the board, with handle and dial on the front, and one Weston round-pattern shunt ammeter. Three power panels will be of 1,000 kilowatts capacity and one will be of 500 kilowatts capacity.

Eight electric capstans will be furnished and set on a body of concrete. Three electric winches, each capable of lifting 20,000 pounds 15 feet a minute with a purchase of five to one, having two speeds, geared nine to one on the power side and three to one on the speed side, will also be furnished. Electric motors of street-railway type designed for capstan-and-winch service, with necessary controllers and magnetic cut-outs, are to be geared to the capstans and winches. The speed of the motors will be about 500 revolutions a minute and the capacity about 30 horse power each.

There will be three vertical, cross-compound, condensing, automatically governed engines, each engine direct-connected to two dynamos. Pumps for the three injector condensers will be vertical, triplex, electrically driven pumps, composition lined. A 20-ton traveling electric crane is to be installed in the dynamo room of the power station.

When completed, this dock will be a thoroughly modern one, capable of receiving the largest battleship. The electric plant for pumping and for operating the gates will be the finest that can be provided. A. F. T.

Amusing if True.

An Indianapolis dispatch, dated July 15th, states that W. F. Brown, a New York attorney, bought the Indianapolis and Broad Ripple Rapid Transit company, a suburban electric line, for $200,000 at auction on that day. The only one who wanted the road was the Indianapolis Street Railway company, which controls all the lines in the city. The owners of this company organized a straw company to buy in the Broad Ripple line. There was some misunderstanding, in which Ferdinand Winter, attorney for the Indianapolis company, bid against Brown, who was employed by the straw company. Nobody knew Brown, and he and Winter between them ran the price up to $200,000 before they discovered they were both bidding for the same employer. The competition stopped immediately, of course, and all efforts were bent on covering up the blunder, the street-railway managers being desperately anxious to avoid the ridicule of the city.

CORRESPONDENCE.

New York Notes.

New York, July 17.—Another Brooklyn street-railway strike is on—one that promises to be less fiercely contested than that of four years ago, but still distressing and annoying enough. The strike was begun yesterday, but cars were run at irregular intervals under police protection. There was considerable disorder. Several employes of the company and passengers were injured by missiles thrown at the cars, and a number of strikers were clubbed by policemen.

The demands of the men, said to have been refused by President C. L. Rossiter of the Brooklyn Rapid Transit company, which is now the "whole thing" in Brooklyn, do not seem to be unreasonable. They are:

1. That the time-tables be arranged upon all lines to comply with the 10-hour law workday.
2. That the prevailing rate of wages shall be $2 for each full day's work and trips overtime be paid at 20 cents an hour.
3. That two-thirds of the cars shall be full-day runs.
4. That the company shall receive committees of its employes representing the men; that no employe shall be discriminated against for acting on such committee.
5. That no man shall be discharged without just and sufficient cause, and only after he has had an impartial hearing.
6. Extra brakemen on the main line: First 15 to report for work at 4:40 a. m.; balance at 5:30 a. m. All brakemen to be paid from 15 minutes after their reporting time when marked up for runs. When extra brakemen are held for Rockaway or Coney Island runs they are to be paid for all fifths over one hour. That all brakemen, agents, gatemen and platform men be paid 20 cents an hour or any fraction thereof.

The company claims that the men have now substantially all the privileges they ask for, but that they are in a fighting mood and wanted to strike anyway. The company has declined arbitration, saying there is nothing to arbitrate. Albert L. Johnson, former president of the Nassau Electric Railroad company, which sold out to the Rapid Transit company, sympathizes with the men and gave them a check for $500. The company employs about 3,500 men, but not all of these have struck. The track mileage of the system is about 400 miles.

At present the strike is confined to Brooklyn, but there is undoubtedly some discontent on the Metropolitan lines in this borough, and several conferences have been held between Mr. Vreeland and his men.

Two electric linemen lost their lives in this city on Thursday last—George Payne of the Brooklyn Fire Department and Gustave Hannan of the Edison company of Brooklyn. Both were killed while on poles and by contact, it is believed, with live wires either crossed with other wires or inadequately protected by insulation. Undoubtedly both men could have saved their lives by proper precautions.

Plans and specifications have been submitted to the Department of Buildings for a one and two-story brick-and-granite fireproof electric power house, to be erected for the Third Avenue Railroad company at the northeast corner of Ninth avenue and Two-hundred-and-sixteenth street. The engineers estimate the cost of construction at $1,000,000. The building will have a steel frame and will occupy a plot 319 by 246 feet. Isaac A. Hopper, who will build the structure, has filed an application for a permit to begin at once to drive piles and build self-sustaining masonry necessary for the foundation.

Captain Frank S. DeRonde, very well known to many electrical men, lives on the Teaneck Road, between Hackensack and Englewood, N. J., and he is active in opposition to the effort of the Gas and Electric company of Bergen County to string its wires along that thoroughfare. It is said that he and other owners of fine homes have employed a number of private watchmen to prevent the electric-light linemen from putting up the poles surreptitiously. Teaneck Road is one of the finest thoroughfares in Bergen County, and is bordered by the grounds of many well-known men, who object to the disfiguring poles. M. S.

Northwestern Notations.

Minneapolis, July 15.—Seymour, Ia., is taking bids for an electric-lighting plant.

Foree Bain, the Chicago electrical expert, wants $200 for his services in examining the electric elevators in the Hennepin County court-house, Minneapolis, and has sued the county. He has been paid $500, but asserts that he had to bring an assistant with him from Chicago, and that the County Board agreed to pay him $700.

Henry A. Salzer has bought the electric-light plant at Darlington, Wis., from Frank S. Walker.

The street-railway company in Des Moines, Ia., is putting in heavier steel for its downtown loops.

W. S. Hammond has found it necessary to put in a new 150 horse power engine for the electric-light plant at Grinnell, Ia. This will about double the capacity of the plant.

Governor Lind of Minnesota has appointed the following-named members of the new bureau for examining wiring experts: William I. Gray of Minneapolis and Joseph McCauley, St. Paul, as journeymen electricians, and Charles L. Pillsbury of Minneapolis as municipal electrical inspector. The law applies to counties having a population of 125,000 or over, and thus takes in only Minneapolis and St. Paul.

All the track is laid for the electric street-car system in Fond du Lac, Wis., and the cars are running on part of the line.

The Madison (Wis.) City Council has ordered all electric-light, telegraph and telephone wires around the state capitol grounds to be put underground within the next 60 days.

The Westinghouse company declined the contract awarded at Wadena, Minn., for a dynamo, and the village has let the contract to the Electrical Machinery company of Minneapolis.

The Twin City Electric company of Grand Rapids, Wis., has begun work on a new power house.

The street-car company of Sheboygan, Wis., is preparing to begin work on the extension to Sheboygan Falls, Wis.

The new electric-light plant at Homer, Neb., will soon be ready for operation.

The new electric-light plant at LeRoy, Minn., has been completed and put in operation.

There is a clash in prospect at Fond du Lac, Wis., between the electric-railway company and the Northwestern railroad people. The former proposes to cross the tracks of the latter, which the railroad officials say shall never be done.

High water carried out the flume head and threat-

ened to undermine the power plant of the electric-light company at Kaukauna, Wis.

Rockford, Ill., and Oshkosh, Wis., capitalists propose to invest $75,000 at Stevens Point, Wis., in improvements to the electric-light plant and by putting in a gas plant.

Bishop & Slusch of Racine, Wis., are the latest applicants for a franchise to operate an electric-light and gas plant in Manitowoc, Wis. The council does not seem disposed to act upon these applications, for there are two others waiting for an electric-car line.

F. H. Werner has bought the stock of electrical supplies in Oshkosh, Wis., formerly owned by W. L. Rideout.

The Pioneer Fuel company's dock in Duluth, Minn., on Rice's Point, is to be operated by electricity. It will be the first dock at the head of the lakes to adopt that power.

Arrangements have been made at Montello, Wis., to resume lighting the streets by electricity.

A new repeater and switchboard of the police and fire-alarm system has been put in at Oshkosh, Wis.

The Citizens' Traction company of Oshkosh, Wis., is rebonding its city tracks with bonds of low resistance, to overcome any possible tendency of the current to escape and cause electrolysis.

The Montana Water, Electric Power and Mining company has been incorporated at Philipsburg, Mont., with $500,000 capital stock. It is understood that work will soon be begun on the proposed electric plant at Flint Creek Falls.

C. N. Parker of Brainerd, Minn., has disposed of his electric street-railway material to the Interstate Traction company of Duluth, Minn., which is about to change its system from horse to electric power.

The Merrill (Wis.) Street Railway and Lighting company has started the machinery of the new power house and finds it works well. The company was burned out a few months ago, but has now replaced the power station with better equipment than before. The street cars and electric street-lighting service have now been resumed.

The Electric Light company of Iowa City, Ia., has let the contract for the erection of the new power house, to replace the burned station. The new building will be thoroughly fireproof and will have the most modern equipment.

The Twin City Rapid Transit company will erect a power station at Wildwood to furnish power for the interurban line to be constructed between St. Paul and Stillwater, Minn. The distance is 20.44 miles, and the company expects to make the trip in 55 minutes, running time. The company proposes to have a fine park at Wildwood, with attractions such as summer operas and the like.

The Des Moines (Ia.) Edison Light company will spend about $50,000 this year in improving its two plants there. It will include additional room at the stations, new arc lights and incandescent dynamos.

J. P. Brown & Co. have been granted a 25-year franchise for an electric-light plant in Waterville, Minn. The plant is to be in operation in 18 months.

The Durand Light and Power company has been formed at Durand, Wis., with $25,000 capital stock. It will develop water power at Eau Galle, and transmit the power electrically to Durand.

Jackson, Minn., has voted bonds for $10,000 for an electric-lighting plant.

W. J. Gray & Co. of Minneapolis secured the contract for an electric-light and water system at Mayville, N. D.

John D. Cuddihy and Edward Ryan have been granted a franchise for an electric-car line through Calumet, and will construct an electric system from Laurium and Red Jacket, Mich. J.

Canadian Intelligence.

Ottawa, Ont., July 15.—For some months past it has been reported that the water power at Fenelon Falls, Ont., was to be developed for the purpose of transmitting electric power to Lindsay, Ont., a distance of 14 miles. It is now stated that the undertaking has been definitely decided upon by the Light, Heat and Power company of Lindsay, which expects to have the new plant in operation by the 1st of October. This company has commenced the work of construction and is arranging plans for the development of about 1,200 horse power. The electric plant will eventually consist of two 400-kilowatt, three-phase generators, direct-coupled to turbines. The company has placed an order with the Canadian General Electric company for one 400-kilowatt generator, together with switchboards, step-up and step-down transformers and all other apparatus required to complete the electrical installation.

An immense project has just been undertaken by the Lake Superior Power company. It is the developing of 60,000 horse power at Sault Ste. Marie, Ont. Contracts for the power stream have recently been awarded to the Mason-Hoge company of Chicago, Hubbell & Co. of Saginaw, Mich., and E. D. Smith & Co. of Philadelphia, Pa. The contracts already let aggregate $2,000,000. The power stream will be one mile and a quarter in length, 200 yards in width and the water will be 19½ feet in depth. Already 500 men are employed on the undertaking. A manufacturing establishment, covering an eighth of a mile of ground area, will be erected at once.

The Canadian General Electric company is introducing a series alternating arc-lighting system to its patrons, which permits of the operation of arc lamps in series from an alternating-current generator of any standard periodicity. It is thought that this system will tend to revolutionize the systems now in use in Canada for street lighting. Appreciating the advantages to be obtained, the Sherbrooke Gas and Water company of Sherbrooke, Que., has placed an order with the Canadian General Electric company for a complete equipment of 100 of these lamps, with transformers.

Mr. T. A. Smith, district superintendent of the Bell Telephone company, at Kingston, Ont., has invented special instruments of unique design for communication between the attendants on the surface and the divers at the bottom of the river, while they are engaged in the work of raising the Cornwall bridge across the St. Lawrence at Cornwall, Ont. The ordinary diving apparatus has been replaced by special diving bells, so constructed as to withstand the pressure of the current. The telephone is put inside the bell, and electric alarms give the signal when either person desires to converse.

Lord Strathcona, Hon. J. I. Tarte, minister of public works for Canada, and Sir Sandford Fleming, C. E., as expert in the matter, have been commissioned by the Dominion government to act as Canada's representatives at the conference between Sir Michael Hicks-Beach and Hon. Joseph Chamberlain, the agents-general of the Australian colonies and the representatives of the Dominion, at which the whole Pacific-cable project will be considered.

Probably the first municipality in the world to own and control a long-distance plant for the transmission of electric power will be the town of Orillia, Ont. Electric energy is now supplied to the town by steam power, and it is proposed to obtain power from the Ragged Rapids of the Severn River, which flows into the Georgian Bay, and it is expected that fully 2,000 horse power will be developed at that point alone. Besides these rapids, there are other falls along the river, so that altogether it would be possible to develop upward of 10,000 horse power. The rapids are about 18 miles from Orillia. It is interesting to note that this is the first plant of the kind in Canada where aluminum wire, instead of copper wire, is being used for transmission. The price of the latter was so high that experiments, which proved satisfactory, were made with aluminum. W.

New England News.

Boston, July 14.—The suit of the Pennsylvania Steel company against the Boston Electric Light company, to enforce payment of the former's claim for construction work, contested by the light company on account of the collapse of the structure put up by the steel concern, has been settled out of court.

A new corporation of Massachusetts men, organized under Maine laws, is the Electrical association, limited, a construction company, with authorized capital of $300,000, of which $500 is paid in. Charles H. Newhall of Lynn is president and H. P. Clough of Lynn treasurer. Robert P. Clapp of Lexington, J. S. Bartlett of Lynn and Charles H. Tolman of Portland are other corporators.

E. Jones, F. A. Drury and N. Sagendorpt are incorporators in this state of the Citizens' Gas and Electric Light company of Spencer, Mass. The capital is $60,000.

The Pepperell Manufacturing company, which runs the biggest cotton mills in Maine, at Biddeford, contemplates substituting electricity for the present system, and expects to save $60,000 annually by reduction of coal cost.

Plans for the Boston Elevated Railway company's immense new power plant on Lincoln wharf, in this city, have reached the stage at which it becomes possble for the management to go before the harbor and land commissioners of the state and submit their project for approval. The site is to be filled in to the regulation line of the water front and about $2,000,000 will be expended in construction and equipment work. There will be a big battery of boilers and seven engines and electric generators powerful enough to run the entire system of surface service as at present constituted. To the preliminary equipment already contracted for with the Westinghouse and General Electric companies, there will be added later, it is stated, enough to bring the horse power of the plant up to 28,000. The company furnishing the most efficient generators in the early contracts will probably be awarded the orders for additional machinery.

The Norfolk Western Street Railway company, which recently opened a line in Norfolk County, this state, between Dedham, Westwood and Medfield, a distance of nine miles, has been granted a franchise to extend the line through Millis and Medway to Franklin, covering a distance of 23 miles in all. Its cars will also be permitted to run over connecting lines to Milford. B.

PERSONAL.

John S. Speer was a Chicago visitor last week, calling on old friends.

Thomas G. Grier of the Western Electric company, Chicago, is spending a well-earned vacation among friends in the East.

On account of the death of Edwin Jacoby, president of the Toledo, Bowling Green and Fremont Electric Railroad company, Walter B. Brockway, formerly of Jamestown, N. Y., was recently elected president pro tem.

Clifford Jennings has resigned his position as superintendent of the Electric Light company at Honesdale, Pa., to accept a position with the Westinghouse Electric and Manufacturing company of Pittsburg.

Joseph Wetzler, president of the Electrical Engineer Institute of Correspondence, New York, has had the honorary degree of electrical engineer conferred upon him by the Stevens Institute of Technology, of which he is a graduate.

Charles F. Boyce, now electrician and superintendent for the City Telephone company of Grand Rapids, will remove to Detroit on September 1st to assume the position of electrical engineer and superintendent of equipment with the Michigan Telephone company—a position he filled some years ago.

W. R. Cassells, a prominent merchant of Buenos Ayres, with the additional distinction of being the first person to introduce electric lighting in South America, was in Chicago last week. Mr. Cassell's friends in Chicago were delighted to meet him again and endeavored to make his visit a pleasant one.

Walter A. Crowdus, the well-known inventor of the Crowdus storage battery, has just returned from an extended trip in Europe in the interests of the Crowdus accumulator and automobile. Mr. Crowdus expects to establish a factory in Chicago for the manufacture of the apparatus bearing his name.

R. V. West of Middletown, Pa., formerly superintendent of the Bloomsburg Electric Light and Power company, and for some time past superintendent of the Middletown electric-light plant, has taken charge of the Nanticoke electric-light plant, taking the place of Superintendent Williams, who died recently.

Frank G. Robinson, one of the proprietors of the Sharpsville Electric Light company, was killed at the power house in Sharpsville, Pa., on July 8th. He was attempting to tighten a loose bolt on one of the generators without stopping the machinery, and in some manner received the current from the machine through his body.

Luther Stieringer was recently presented a handsome imported watch with gold hunting case and mechanism for striking the hours and minutes. The inscription on the watch is: "Presented to Luther Stieringer by the Electrical Exhibition company in recognition of valuable and gratuitous aid rendered in connection with the Electrical Exhibition held May, 1899." Mr. Stieringer's expert assistance was of great value to the managers of the New York show and it is recognized in this pleasant manner.

ELECTRIC LIGHTING.

The Napa Gas and Electric company has been incorporated at Napa, Cal., by Thomas Addison, John L. Howard and O. E. Clark, with a capital of $100,000.

The plant of the Bellwood electric-light company at Bellwood, Pa., was sold at sheriff's sale recently for $7,100 to the first-mortgage bondholders. The total liabilities were $31,000.

The bid of Priestman & Co. of Philadelphia, Pa., in amount $3,818, was the lowest received by the War Department for installing an electric-light plant at the Dumplings, Conanicut Island, R. I.

The Slatington (Pa.) Borough Council has awarded the contract to light the streets of that town to the Slatington Electric Light and Power company at $59 for each arc light, or $2,360 a year for 40 lights.

The lowest bid received by the Treasury Department for the installation of a system of conduits and wiring for electric lighting in the United States public building at Camden, N. J., was that of the Brown Electrical Construction company of New Haven, Conn., at $1,994.

ELECTRIC RAILWAYS.

The Linglestown and Progress Railway company of Reading, Pa., is securing rights-of-way for a trolley line from Harrisburg to Linglestown, a distance of eight miles.

An ordinance was recently passed in Redlands, Cal., granting to the Redlands Street Railway company a franchise for an electric road over certain streets for a period of 39 years.

The Ramsey street-car barns of the Twin City electric railway at St. Paul were burned on July 18th. Sixty electric cars were destroyed, together with the building and a quantity of general supplies. The loss is estimated at $125,000.

The construction of the new electric road between Brooklyn and Rockaway Beach by the New Jersey Construction company has been begun. The new road will be built by a syndicate, headed by Patrick Flynn of Brooklyn, and will cost $1,000,000.

The contract for the laying of the track for the Mount Pleasant, Scottdale and Connellsville electric street railway in Western Pennsylvania has been

awarded to a Brooklyn firm. It is expected to have part of the line in working order in August.

With the exception of a short strip at Kenilworth the electric-railway line between Evanston and Waukegan, Ill., is now practically completed. It will not be long before one can ride by electric car from Chicago to Milwaukee.

Trolley cars are now running on State street, Chicago, from Sixty-third street to Van Buren street. The Chicago City company secured permission to string the poles and wires temporarily while repairs are making to the cable power plant.

The purchase of the right-of-way of the Media, Middletown, Aston and Chester Trolley company has been made by the syndicate interested in the new line which is going through Swarthmore, Darby, Morton and other points between Chester, Pa., and Philadelphia. F. W. Hammett is president; David Woolerstine is solicitor and Samuel L. Kent and B. G. Jones are directors.

AUTOMOBILES.

Mayor Quincy of Boston has vetoed the ordinance adopted by the Board of Aldermen, by which it was sought to regulate the use of automobiles in that city.

A Paris dispatch states that 67 motor cars started on the morning of July 16th to race around France, a distance of 1,450 miles. The trip will occupy nine days, with two intervals of a day each.

The automobile has taken the fancy of Newport society. Not only are the male members of the cottage colony using them, but some of the ladies are also trying their hand at running the new vehicles.

An Elgin, Ill., dispatch states that $10,000 has been paid as earnest money on the purchase of the Elgin Sewing Machine and Bicycle Works, that have long been idle. The buyers are automobile manufacturers, who will start work at once.

C. W. Koch, a Detroit carriage-builder, said in a recent interview: "While the coming of the electric car and the bicycle has almost ruined the trade, the death-blow was given by the introduction of the rubber tire, which practically makes all further repairs unnecessary. This is the present state of the trade. Those shops that manage to make money must have a capital of $50,000 and upward. The horseless carriage, however, is bound to revive our failing trade."

The San Francisco Chronicle states that electricity from the Blue Lakes in the Sierra is to be utilized as motive power for automobiles along both sides of San Francisco Bay and south therefrom as far as San Jose. Propositions to this effect have been received by the Standard Electric company, of which Prince Poniatowski is president, from the Electric Vehicle company of New York and from other concerns. There are to be three routes, with charging stations located at different points around the bay.

Mr. and Mrs. John Davis are making a transcontinental automobile tour. They left New York on July 13th and are bound for San Francisco, by way of Albany, Buffalo, Cleveland, Chicago, Omaha and Denver. They use a vehicle propelled by gasoline and were troubled by breakdowns early in the trip. At Poughkeepsie a machinist was taken aboard to accompany them as far as Buffalo and look after the machine. Mrs. Davis writes for the newspapers en route, and the trip is attracting considerable attention.

It is said that automobiles are to be placed in competition with the street-car systems of St. Louis. A corporation for that purpose has been organized, with a capital stock of $500,000. It is the intention of the projectors to place the system in operation on or before October 1st. Cabs, drags, surreys, tally-hos, carts and omnibuses will be run along certain specified routes for prices which threaten the business of the street-railway companies. In addition to the passenger traffic, the company contemplates a general express business. Among those said to be interested are George D. Rosenthal, St. Louis, agent of the General Electric company; Herbert A. Wagner, general superintendent of the Missouri-Edison Electric company; F. W. Abbott and H. R. Gamble of the General Construction company.

INDUSTRIAL COMBINATIONS.

The organization of the National Tube company, a consolidation of the wrought-steel, iron-tube and pipe industry of the United States, was completed a few days ago. The National Tube company constitutes the largest tube concern in the world, and it is the third largest steel and iron corporation in the world, only the Krupps and the Carnegies exceeding it. It embraces the controlling interest in the steel-tube and iron industry, and owns and is now operating over 20 plants, the largest of which is located at McKeesport, Pa. These plants are now turning out about 1,100,000 tons of all classes of tubular goods of wrought-iron and steel, embracing hundreds of varieties from one-sixteenth of an inch to three feet in diameter. The company gives employment to 25,000 men. Its authorized capital has been increased to $80,000,000. At a full meeting of the board of directors the following-named officers were elected: President, Edmund C. Converse; chairman of the board, Joshua Rhodes; first vice-president (in charge of manufacturing), F. J. Hearne; second vice-president (in charge of mercantile affairs), Horace Crosby; third vice-president (financial), Francis L. Potts; general manager, manufacturing department, A. S. Matheson; treasurer, Arthur F. Luke; assistant treasurer (at Pittsburg), William H. Latshaw; general counsel, Sullivan & Cromwell. The changes in the board of directors comprise the substitution of William S. Eaton for D. W. Hitchcock and the addition to the board of three representatives of J. P. Morgan & Co.—Messrs. Coster, Hamilton and Gillard.

PUBLICATIONS.

The Harrison Safety Boiler Works of Philadelphia issue a pamphlet to direct attention to the merits of Cochrane feed-water heaters and separators. The pamphlet is unique in composition and make-up and presents the advantages of the Cochrane apparatus in a forcible manner.

The Ward Leonard Electric company has just issued a catalogue of 16 pages devoted exclusively to Carpenter enamel rheostats. This catalogue of field rheostats is a comprehensive one, containing detailed information regarding 125 different standard forms of field rheostats which are customarily carried in stock by the Ward Leonard company. Each one of the rheostats listed has its own code word, which makes the catalogue convenient for foreign customers.

MISCELLANEOUS.

Fred Bussler, an employe of the Lycoming Electric company of Williamsport, Pa., recently had an electric current of 2,000 volts pass through his body while adjusting a switchboard. He fell unconscious to the floor, but physicians succeeded in resuscitating him.

At Muelheim-on-the-Ruhr, Germany, a blast-furnace chimney was struck by lightning, being perforated at 23 places. It is stated that the holes did not interfere with the draft, since the waste gas from the hot-blast stoves was carried off as before. Repairs were made while the furnace continued in blast.

The Washington Star of July 10th makes mention of a strike of the local union of the National Brotherhood of Electrical Workers. The union has, it is said, about 100 members and contains nearly all the electrical workers in the District. The members struck for $3 a day for eight hours' work. The strike was due to dissatisfaction over the wages, which ranged from $2 to $2.50 for a day of nine hours.

TRADE NEWS.

The plant of the Raritan Electric company at New Brunswick, N. J., was destroyed by fire recently. The loss was nearly $100,000, with about $70,000 insurance. The company was recently organized by New York capitalists to succeed the Beacon Lamp company.

The Columbia Incandescent Lamp company of St. Louis is making some changes in its Pacific coast business. The Paul Seiler Electrical Works, which have been its coast agents for several years, will still handle the Columbia lamps, but in addition to this agency the Columbia company has opened a branch office in San Francisco at 120 Sutter street in charge of Alexander R. Pike, and will maintain a large and well-assorted stock of lamps for the Pacific coast trade.

The Farley Loetscher Manufacturing company of Dubuque has let a contract to the Star Electric company for a complete isolated electric plant, with a capacity of 25 arc and 350 incandescent lights, including generator, switchboard and the wiring of the entire factory.

James G. Biddle of Philadelphia states that Morris E. Leeds & Co. have purchased the plant, drawings, fixtures, etc., of Elmer G. Willyoung & Co., and will continue the business at the old address, 939 Boyer street, Philadelphia. Mr. Leeds was formerly with Queen & Co. Mr. Biddle, who acted as sole agent for Willyoung & Co., will act in the same capacity for Leeds & Co. The field covered by Leeds & Co. comprises electrical measuring instruments, X-ray apparatus, psychological apparatus, apparatus for physical laboratories, etc.

BUSINESS.

The Advance Specialty company, Chicago, manufacturer of electric gas-lighting specialties, reports a wide demand for its devices, which are meeting with great favor.

The Central Electric company, Chicago, is issuing a liberal amount of advertising matter pertaining to electric-railway supplies. It reports receiving and shipping a generous line of electric-railway material.

The Metropolitan Compound Manufacturing company of 26 Court street, Brooklyn, N. Y., reports a very good business with its boiler compound. It sends a trial order on approval, and is daily increasing its list of customers.

W. N. Matthews of 312 Commercial building, St. Louis, says that he has disposed of all his second-hand weatherproof wire and his entire lot of Fort Wayne arc machines. His Russell engine has also been sold, but he has still a long list of second-hand apparatus.

A. W. Knutson & Co. of Galesburg, Ill., manufacturers of the popular Knutson gravity clutch for arc lamps, report that the demand for this device has exceeded all expectations. This clutch is being used by leading electric-light companies throughout the country, and through its use, it is said, electric-light managers are enabled to make a large saving in lamp repairs. Knutson & Co. will be pleased to send further particulars to those interested.

The Western Electrical Supply company of St. Louis reports that the sales of the Adams-Bagnall enclosed direct and alternating-current arc lamps have been unprecedented. The public has been quick to recognize the many advantages, good points and wonderful improvements which have been made in this lamp. The Allegheny County Light company, Pittsburg, Pa., after a series of tests of all of the most prominent lamps on the market, placed its order for 1,400 Adams-Bagnall enclosed arcs, to be used throughout its system. This is one of the largest orders that has been placed lately, and, considering the competition, it speaks well for the quality, workmanship and general efficiency of the Adams-Bagnall lamp.

Walsh's Sons & Co., doing a general second-hand business in Newark, N. J., are making a very special drive in handling second-hand electrical machinery. This concern is one of the oldest, most reliable and best known institutions of its kind in the neighborhood of New York, and with its headquarters in Newark, N. J., it is in excellent position to command quite an extensive market in the purchase and sale of second-hand electric apparatus. In addition to the line of electric machinery which the firm has on hand it now has in stock a quantity of guy cable for telephone construction and also a lot of other material suitable for the service in the hands of the telephone contractor. Walsh's Sons & Co. buy as well as sell second-hand machinery, and the buying branch of the business is chiefly handled by P. Walsh, Jr. Mr. Walsh is an energetic young man and realizes the value of coupling with shrewd business judgment great courtesy and fair treatment, not only to buyers but to sellers as well. As a consequence the firm's electrical department is naturally prospering.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 11, 1899.

628,448. Igniter for Gas Engines. Charles O. Carlson, New York, N. Y. Application filed May 7, 1898.

In an electric igniter for gas engines the combination of a shaft, a cam on the shaft, having a peripheral cam face and a side cam face, a rotary and longitudinally movable shaft, the cam faces being in operative relation with the movable shaft, electrodes, and connections between the movable shaft and the electrodes whereby contact is made and broken.

628,457. Device for Producing Electric Currents at Sea by the Action of Waves. Max Gehre, Rath, Germany. Application filed April 6, 1899.

Floats moved by the waves of the sea are connected to rods projecting from the sea. One rod carries at its upper end an armature with an induction coil; another carries a magnet with alternating poles.

628,464. Electric Signaling Apparatus and Circuit. Felix B. Herzog, New York, N. Y. Application filed October 25, 1884.

Features enumerated are: Circuit controllers at several outlying stations, a separate line from each to a common station, each controller comprising normally separated terminals and means for effectively joining these and so completing the circuit, means for retaining the circuit closed, a restoring magnet for each line arranged to control its reopening, at the common station an annunciator composed of separate annunciator elements for each line, each adapted to respond to the operation of the corresponding circuit closer, a separate switching connection for each, whereby each of such distant magnets may be separately controlled from the common station to reopen the closed circuit and thus restore the indicator of that line.

628,472. Time Alarm for Telephones. Hermann Keim, Munich, Germany. Application filed June 14, 1897.

Combined with a clock mechanism are counting disks operated by the mechanism, a longitudinally movable arbor, a lever on the arbor, means for shifting the arbor to bring the lever into engagement with any desired counting disk, an additional arbor, a movable connection between the two arbors, a spring on the second arbor normally retaining the lever in a position to be engaged by the counting disks, and a signal device operated on disengagement of the lever with the counting disk.

628,492. Secondary Battery. Charles Ridsdale, Chicago, Ill. Application filed May 28, 1897.

An electrode for secondary batteries comprising in its construction a section of oxide of lead formed in a complete integral mass having extensions forming ridges along its side or sides and corresponding recesses also formed by the ridges, together with extended channels through the

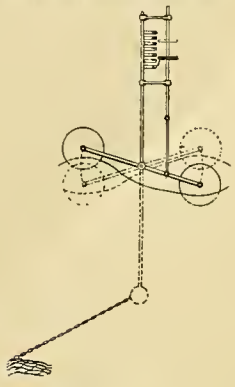
interior of the section and a strip of conducting material extended through the sect on.

628,514. Electric Vehicle. William F. Zimmermann, East Orange, N. J. Application filed May 12, 1899.

The combination with a vehicle of a detachable electric propelling device comprising an electric motor, a source of current and a single axle and traction wheels carrying the same.

628,539. Trolley Wheel. John Kalte, Port Elgin, Canada. Application filed March 11, 1899.

In a trolley wheel and bearing, in combination, the divided harp, an axle connecting the parts thereof, a trolley wheel having a central hub, a double cup fitted therein, cones threaded on the axle, ball bearings and flanges extending inwardly from the sections and overhanging the hub of the wheel and closely fitting the same.



NO 628 457.

628,567. Telephone-switch Apparatus, Signal and Circuit. Thomas C. Wales, Jr., Newton, Mass. Application filed April 17, 1899.

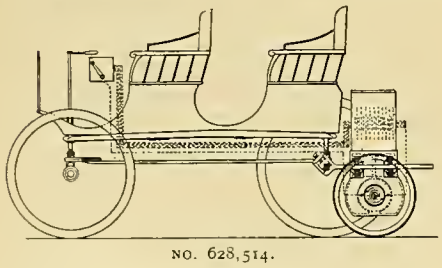
This patent, assigned to the American Bell Telephone company, covers the combination in a telephone exchange of a source of current at the central station, a substation telephone circuit represented on the switchboard by switch sockets or jacks, having its conductors extended to the source of current, and provided at the substation with a circuit-controlling switch, a local trunk circuit at the central station having a switch plug and a switch socket at its terminals respectively, and being conductively separated into two inductively united divisions by an induction coil with four windings, two of which are included with the source of supply and a circuit-closing relay in the switch-plug division, and the remaining two in the switch-socket division, a test battery and local circuit, and a second circuit-closing relay, associated with the switch-plug division, a third circuit-closing relay and a lamp signal controlled thereby, associated with the switch-socket division, and a linking or switch-cord connection circuit, having a bridge between its main conductors and a branch to a grounded battery extending from the center of the bridge, and having also a signal included in one of the main conductors, whereby when the circuits are switched to form a through circuit the cord signal may be operated from the substation, and the lamp signal of the trunk-line-socket division operated by the removal of the cord-connection plug from the trunk-line socket.

628,597. Electric Elevator Alarm. Henry R. Bruhns, San Francisco, Cal. Application filed December 30, 1898.

A series of independent signals, each having a circuit-closing device and an electrical circuit, a spring projecting into the path of the elevator so as to remain depressed during the passage of the entire length of the elevator, a fulcrumed lever and a push bar connecting one end with the spring, a push button actuated by the opposite end of the lever to close the circuit, and a second spring interposed between the push button and the lever to compensate for irregularities of movement of the lever and push-bar.

628,610. Trolley Pole. Stephen G. Reynolds, Easton, Pa. Application filed January 7, 1899.

A trolley pole for electric cars, having an integral forked upper end, a central vertically disposed grooved roller mounted in the crotch of the fork, and grooved horizontally arranged side rollers mounted in the fork branches above and in rear of the central roller substantially at right angles thereto.



NO. 628,514.

628,650. Electric-lighting System for Cars. John L. Creveling, New York, N. Y. Application filed January 31, 1899.

The system comprises electric lamps, a storage battery and a generator driven by power derived from the motion of a car, an electric switch adapted to reverse the connections between the generator and the battery mains upon the reversal of direction of rotation of the armature, this switch being operated by frictional contact with a movable member or members, the direction of motion of which is reversed with the direction of rotation of the armature, with a centrifugal governor adapted to break the frictional contact at a predetermined speed and to complete the dynamo circuit through the battery at a higher predetermined speed, and independent spring mechanisms whereby the two operations may be independently adjusted.

628,658. Electric-lighting Apparatus for Railway Cars. Charles A. Gould, New York, N. Y. Application filed July 7, 1898.

One of the car axles is provided with a pulley. A dynamo is yieldingly mounted on the car above the axle, so as to be capable of moving vertically toward and from the same, and a driving belt connects the car-axle pulley and the pulley of the dynamo shaft.

628,661. Battery Electrode. John C. Howell, London, England. Application filed July 8, 1898.

A battery electrode comprising a metallic ribbon in the form of a helix with each turn in the form of a cone and partially covering the next preceding turn.

628,667. Insulated Rail Support. Charles K. King and George A. Mead, Mansfield, Ohio. Application filed May 24, 1899.

A support for electric conductors, comprising a cap, a block of insulating material upon which the cap rests, two clamps carried by the cap and having means for preventing their turning, and an elongated vertical portion to permit of free vertical movement.

628,676. Forming Accumulators. Charles Pollak, Frankfort-on-the-Main, Germany. Application filed March 14, 1898.

The process of forming lead electrodes in accumulators, consisting in first treating them as anodes in electrolytical elements with a current having a tension which does not exceed two volts an element, thereby producing a covering of lower oxide of lead, and then completing the formation by the use of a current having an electromotive force in excess of two volts.

628,685. Theater Dimmer. Arthur W. Berresford, Westfield, N. J. Application filed February 27, 1899.

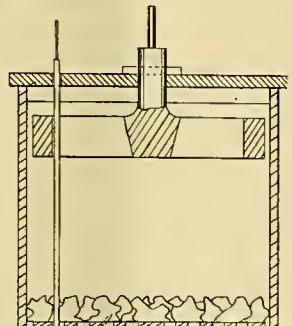
A theater dimmer comprising a suitable supporting frame, a plurality of resistance plates, a contact lever and contact points carried by each plate independently of adjacent plates and means for securing each plate to the supporting frame in removable adjustment.

628,686. Plating Machine. Hermann R. Boissier, New York, N. Y. Application filed December 22, 1898.

This is an electroplating machine having a tank containing the electrolyte, one or more anodes in the tank, a reciprocating holder, guides relatively stationary to the tank for guiding the holder, a detachable depending hanger for the work carried by the reciprocating holder, and electric circuits connecting with the anodes and detachable hanger.

628,695. Electrical Cooking Apparatus. John B. Cary, Baltimore, Md. Application filed March 10, 1899.

A device consisting essentially of heat-retaining cylinders to utilize the heat of electric lamps or electric conductors is described.



NO. 628,739.

628,696. Molding for Electric Wires or Other Purposes. Milton Chase and De Forest W. Chase, Boston, Mass. Application filed October 17, 1898.

A molding for rooms consisting of two parts, one part adapted to be permanently secured in place, grooves to receive the electric wires formed therein and having at its lower end a projection and at its upper end a lip, the other part having a molding on its face and adapted at its lower end to fit onto the projection and its upper end to fit over the lip at the upper end of the fixed portion.

628,702. Electrical Hot-air Heater. John A. Elliott, Butte, Mont. Application filed January 10, 1898.

The combination of an outer air-tight tank, of an inner casing spaced therefrom to form top and side chambers, this casing being provided with openings at its base, of an air pipe entering the side chamber and discharging into the top chamber, the pipe being formed with coils vertically disposed within the side chamber, an electric heater with suitably insulated connections within the inner chamber, and an air pipe discharging from the inner casing.

628,739. Primary Battery. Edward Baines, New York, N. Y. Application filed December 29, 1897.

The claim is made for a gravity battery having a negative electrode of electro-negative material located in the lower part of a jar and in a solution of copper sulphate, and having a positive electrode of zinc located in the upper part of the jar and in a solution of zinc sulphate; a grid of non-metallic material is located between the electrodes, and crystals of copper sulphate are located on the upper side of the grid occupying the whole of the sectional area of the jar.

628,762. Automatic Circuit Breaker. Charles M. Clark, New York, N. Y. Application filed January 23, 1899.

A circuit breaker provided with a spring-pressed rotary disk normally in position to render the circuit continuous, an electromagnet in the circuit and arranged for action on an overload of current, a spring-pressed latch for normally locking the disk against the tension of its spring, a connection between the latch and the electromagnet for actuating the latch and unlocking the disk upon an overload of current, and an electromagnet for the latch and likewise in the circuit for movably holding the latch in a locking position relatively to the disk and for permitting the spring of the latch to actuate the latter and unlock the disk upon the passing of an underload of current.

628,770. Manufacture of Electric Conductors. Sherard, O. Cowper-Coles, London, England. Application filed December 24, 1897.

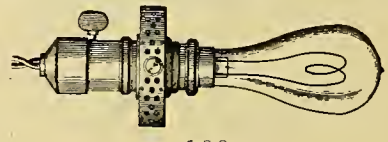
An electric conductor composed of practically pure iron and provided with a metallic coating having a low melting point.

628,782. Electric Furnace. James J. Faulkner, Memphis, Tenn. Application filed November 12, 1898.

The combination with the furnace chamber of two opposing electrodes and means for automatically adjusting one of the electrodes, the means comprising a fixed insulated support for the movable electrode, a sleeve, a spring-actuated plunger mounted in the sleeve and longitudinally allied with the movable electrode.

628,807. Electric-current Transformer. Seth K. Humphrey, Boston, Mass. Application filed October 1, 1898.

A transformer comprising a core consisting of a disk having a series of openings through it, a multiplicity of primaries rove through the openings and over the periphery of the disk, the primaries being arranged in a plurality of sets placed opposite each other and connected, one set with the opposite set, a continuous secondary winding consisting of a series of coils, each having connection with segments of a stationary commutator, and auxiliary windings extended across the center of the disk and connected in parallel with the primaries.



NO. 628,849.

628,849. Electric-current Regulator. Frederick E. Ramsay, Walsenburg, Colo. Application filed October 14, 1898.

One claim reads: A current regulator for electric lamps, comprising a pair of disks of insulating material, a socket piece on one of the disks and a plug on the other, a series of contact plates radially arranged between the disks, a core and a coil of wire wound upon the core in layers, the layers being in electrical connection successively with the plates, a contact block adapted to make electrical connection with one or the other of the contact plates, and a contact spring for holding the contact block in electrical connection with the contact sleeve of the plug.

628,855. Galvanic Battery. Walter Rowbotham, Birmingham, England. Application filed October 21, 1895.

An outer vessel is divided by non-porous perforated partitions into three main compartments, the inner one of which constitutes the active portion of the battery, and the outer ones constitute reservoirs for supplying the active portion of the battery with the exciting fluid; metal and carbon elements are arranged in the inner compartment, the perforations in the non-porous partitions being arranged to put all the metal elements in communication with one of the outer compartments and all the carbon elements in communication with the other outer compartment.

628,856. Electric-railway Switch. Frederick A. Ruff, Detroit, Mich. Application filed May 9, 1898.

The combination of a movable switch member, an insulated section of trolley wire, a connection leading therefrom to a source of electrical energy, an electromagnet included in the connection and mechanism operated by the magnet for throwing the switch member, comprising a walking-beam lever, a connection between the same and the switch member, a lever operated by the magnet, and a pitman operated by the lever having a movable connection with the walking-beam lever and adapted to throw the same alternately in different directions to move the switch in opposite directions.

NO. 31,187.

REISSUE.

11,759. Insulation of Electric Wires. Joseph A. Poché, New Orleans, La. Application filed April 10, 1899. Original number, 608,906, dated August 9, 1898.

An insulation for conductors carrying currents of high potential consisting of a surrounding insulating sleeve and two inclosing glass cones, retained by a collar at one end and a nut at the other.

DESIGNS.

31,187. Telephone-receiver Cap. Henry Rose Cool, Urbana, Ohio. Application filed June 13, 1899. Term of patent seven years.

The design for the telephone-receiver cap shown by the cut.

31,193. Molding for Electrical Conductors. Hubert Krantz, New York, N. Y. Application filed June 15, 1899. Term of patent seven years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, JULY 29, 1899. No. 5

Electrical Heating and Cooking at the Carmelite Hospice.

By Orrin E. Dunlap.

Electricity is now used for lighting, heating and cooking purposes in the new hospice building of the Carmelite Fathers on the Canadian side at Niagara Falls. The plant which has been installed in this institution has several novel features, and as it is operated in connection with Niagara electric energy, it is of much interest. It was installed by Mr. A. Harth, an electrical engineer who makes electric heating a specialty.

The hospice plant consists of a transformer station, which is located about 150 feet west of the main building. It is a small, wooden structure (Fig. 6, page 60), in which are located two 30-kilowatt Westinghouse and one 25-kilowatt General Electric transformers (Fig. 7), primary 2,200 volts and three-phase secondary 110 volts, the current being transmitted from the transformer station to the main building (Fig. 5, p. 61) through an underground cable. The switchboards are located in the basement of the main structure and are two in number. They are shown in Fig. 4 in the group of illustrations on this page. A switchboard with double-throw switches controls two phases of the current, and the third phase is controlled by a switchboard adjoining, and is used for cooking, lights, etc. The switchboards are so arranged that either transformer can be used independent of the other for either purpose.

The total amount of electric power used in the building is 100 horse power. Of this amount 25 horse power is applied to lighting, cooking and heating water, while the remainder, 75 horse power, is devoted to heating the lower floor of the building. The space thus heated consists of 11 bedrooms, reception room and office and the dining room, also the corridor. This corridor (Fig. 3) is 120 feet long, 10 feet wide and 13 feet high. In it have been placed nine four horse power electrical heaters. Each bedroom is 10 by 12 by 15 feet in size, and each has an electrical heater of four horse power, equipped with a changeable-heat switch of two heats.

While there are many places in the country where electricity is used for cooking small dishes, it is probable that there is not another electrical kitchen in the world like that installed in the hospice building, the intention being that it shall have a capacity of cooking all the meals of the residents and guests at the hospice. It is shown in Fig. 1. The kitchen has not been installed as a novelty, merely to outline the possibilities of electrical cooking, but it was adopted to supersede all other kinds of fuel commonly in use in kitchens, coal, gasoline, oil, etc., and it may be said that it has answered all the demands made upon it in splendid style. This kitchen is operated by an electric combination range and three electric ovens. The range has a heating surface of six square feet. Each square foot of surface has its individual switch and can be controlled at full or half heat, as desired. The range, as a whole, consumes 90 amperes of current and each square foot of surface 15 amperes. The oven capacity consists of two small ovens and one large oven. Each of the two small ovens has three compartments and each compartment consumes 23 amperes at 110 volts. The large oven takes 50 amperes and its facilities are such that it will accommodate four large roasts at one time.

The electric current is carried into the butler's pantry, where tea and coffee are made. Here (Fig. 2) are three five-gallon urns and a chafing-dish. Each of the urns is electrically connected. One is used for tea, another for coffee, while the third is used for heating water to supply the tea and coffee urns.

In Fig. 4, adjoining the switchboards on the left, will be seen a barrel-like apparatus. This is the 400-gallon boiler in which water is heated for laundry and bathroom purposes. It takes a current of 120 amperes, being divided into three heats. Opposite this boiler, but not shown in the illustration, stands a smaller boiler of 150 gallons capacity. This boiler is used for heating water for kitchen use, but can be used in connection with the larger boiler. The small boiler takes 125 amperes of current, being also divided into three heats. Both of the boilers are covered with 2½-inch asbestos covering, to add to their efficiency. It may be remarked here that an effort is made to heat the water when there is not a demand for the current for other purposes.

The current used by the installation is obtained from the Canadian Niagara Power company. It is generated in the station of the Niagara Falls Park and River Railway company, which is about two miles distant from the hospice. It is transmitted to the hospice from the station over No. 3 copper wire.

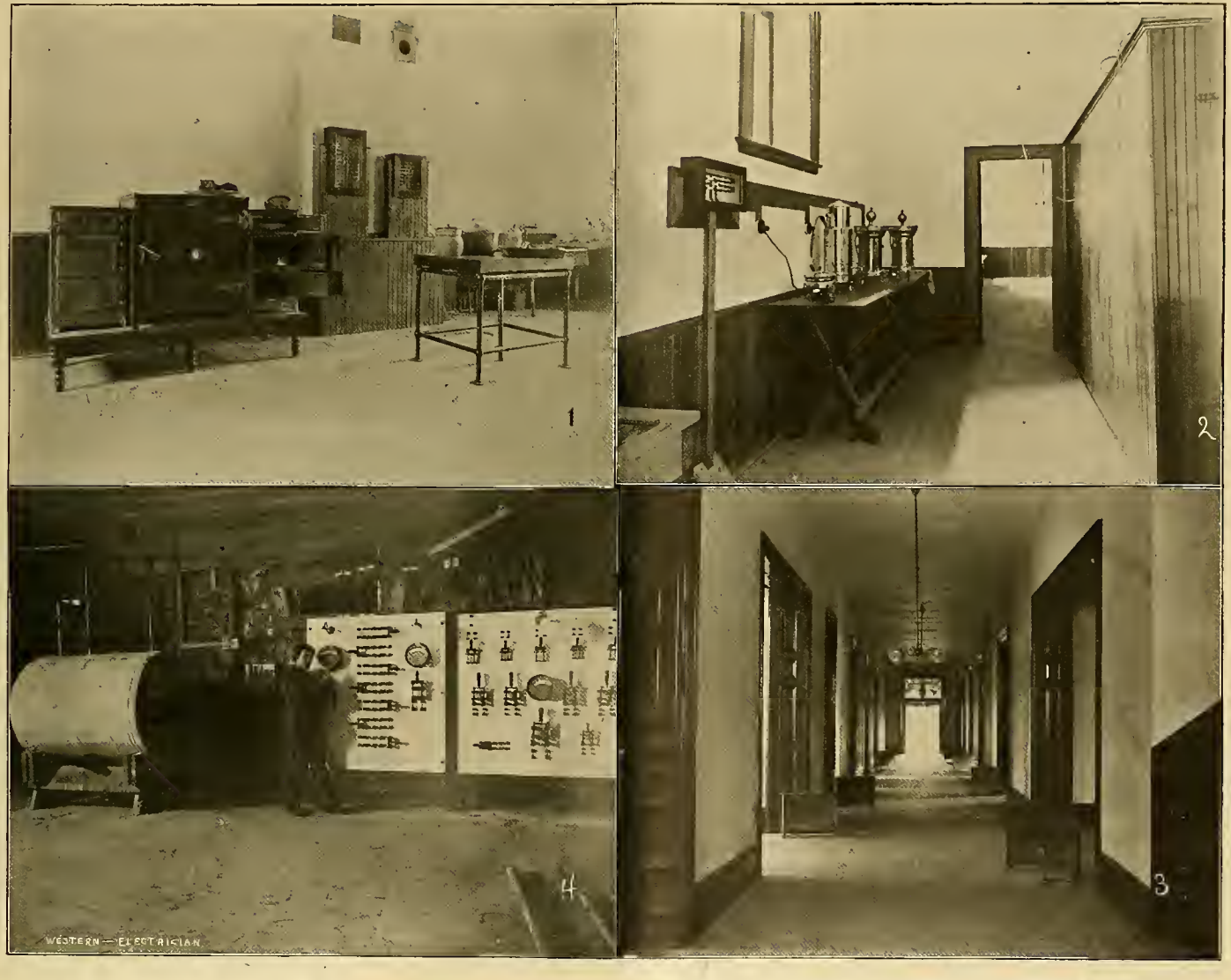


Fig. 1. Kitchen, Showing Electric Stove and Oven.
Fig. 2. Butler's Pantry, with Tea and Coffee Urns and Chafing Dish.
Fig. 3. Electric Heaters in the Corridors.
Fig. 4. Switchboards and 400-gallon Water Heater.

ELECTRICAL HEATING AND COOKING AT THE CARMELITE HOSPICE.

With the exception of times in winter when anchor ice has bothered the generating station, the service has been ideal. The cleanliness and comfort with which electricity can be used in a kitchen has been well portrayed, and the cook in charge speaks very highly of the use of electricity for kitchen work. She has had many years of experience with coal and other fuels, but she pronounces electricity as far superior. As to what can be accomplished by the installation of this kitchen, it may be pointed out that on the occasion of the recent formal opening and blessing of the hospice, dinner was cooked for 250 persons in 2½ hours. This did not include the soup making; this requiring some hours of attention, the soup was prepared the day before.

The efficiency of the ovens has been found to be very high. The door of the large oven is fitted with a thermometer, which indicates the stage of heat at which the oven is prepared to bake or roast. This

FIG. 6. ELECTRICAL HEATING AND COOKING AT THE CARMELITE HOSPICE.—TRANSFORMER STATION.

is plainly indicated, and thus the cook can make no mistake in the proper time at which to place her meats or other articles of food in the oven. As the heat is always uniform, so should be the cook's output from her kitchen. There is a noticeable absence of the smell common where gas is used, and also of the ashes and dirt where coal is the fuel consumed. The dinner or other meal cooked, the heat can be turned off, leaving the kitchen as cool as any other part of the house in summertime. There is no lingering fire to watch and care for; no getting up early to see if the fire is out: no hustling over a slow fire for a quick meal, for the simple turning of a switch sends the current through the range or ovens to any degree the cook may desire. With no call for current in the kitchen, it may be directed to the boilers to heat the water for the various purposes outlined. In the 400-gallon boiler water is boiled from 60 degrees to 212 degrees in six hours with full heat. In the small ovens bread can be baked in 18 minutes.

The special apparatus for the plant was built by the Hadaway Electric Heating and Engineering company of New York.

As to the cost of the current used in the hospice, it may be stated that the 25 horse power used for lighting, cooking and heating water is obtained at $25 a horse power, or a total of $625 a year for this service. The current used for heating the corridor and bedrooms is in use but a small portion of the year, and this at a time when there is a surplus of power in the station, in the winter, when but a small number of cars are operated on the railway supplied with current from this station. This has resulted in the Carmelite Fathers getting the current for heating in wintertime at a very low price, possibly in order to encourage electrical installations of the kind in the vicinity of the Falls. However, the fact that anchor ice has usually given this station trouble in very severe weather has led the engineer who installed the plant to conceive that an ideal installation for any place where there is any possibility of the electric current being intermittent would be a combination electric and fuel hot-water heating plant. Thus the heating system employed would be hot water from a boiler under which an electric or fuel service could be operated. If, for any reason, the current gave out or was interfered with, then the fuel service could immediately be brought into play and the heating system not interrupted in its work.

One who has been an ardent advocate of the use of electricity in the hospice is the Very Rev. Anastasius J. Kreidt, the provincial of the Carmelites in the United States and Canada. For years he has had such a service in mind, and in his relative, Mr. Harth, whose portrait is given on this page, he has found one who has most excellently equipped his institution. The present building (Fig. 5) is but a portion of the plan, as contemplated at this point. When the plan has been perfected the institution will be one of the finest buildings on the Niagara border, the idea being to have a religious house where pilgrims from all sections will be drawn to adore Nature's God in spirit and in truth. The present little chapel or shrine of Our Lady of Peace was erected in the early '20's. The idea of the Niagara hospice was conceived by the late Archbisop Lynch of Toronto, who petitioned Pope Pius IX. to grant all the favors and privileges of the European sanctuaries to the little shrine at the Falls, with permission to transfer the privileges to the new shrine when completed. This was granted, and when the building is completed it will form one of the most striking buildings for completeness of detail and architectural beauty in America. At present the main building and one wing have been built, forming an "L," the dimensions of which are 200 by 250 feet at the foundation line, the height to the top of the towers being 85 feet. In time the hospice and shrine will be combined, and then the shrine will occupy the center between the two wings, the northernmost one of which will be the home for guests or pilgrims and the southern one will be the monastery. From this it will be seen that the Niagara hospice of the Carmelite Fathers is destined to be modern in every particular and founded on the latter-day principles of the order.

Standing on the bluff, back of beautiful Victoria Niagara Free Park, the hospice building overlooks the most magnificent scenery in the world. From it the Falls of Niagara and long distances of the upper and lower river may be seen. Far off to the north the glorious Niagara Gorge runs in all its wonderful sublimity, while the speeding of the waters, as they hurl themselves down from Lake Erie, over reef after reef, in delightful shades of green, broken by the whitened waters of the rapids above the falls, convinces one that not only is Niagara fortunate in its scenic features, but in the wonderful possibilities of its power development, of which the hospice installation is most significant.

Soldering Aluminum.

With the continued high price of copper, aluminum is coming into more extended use as an electrical conductor in places where bare wires are permissible. One objection to the use of aluminum for this purpose heretofore has been the difficulty

A. HARTH, ELECTRICAL ENGINEER FOR THE CARMELITE FATHERS.

in making soldered joints, and many authorities have contended that mechanical joints were the only ones that could be successfully used in electrically connecting lengths of aluminum wire. Mr. H. L. Gronimus of Chicago claims to have overcome this difficulty, and the samples of his work, which seem to bear out his statement, have been examined with much interest by electrical men.

Mr. Gronimus exhibits a soldering metal and a flux, both of secret composition. The flux can be applied with a common brush or with the tips of the fingers. It forms a transparent coating on the surface of the metal and protects it from atmospheric oxidation. It is said that the flux will not decompose or vaporize at temperatures approaching red heat. This facilitates a good adhesion of the solder to the metal, and is especially valuable in electrical work. The solder is a grayish alloy. It is applied with a soldering-iron or blow-pipe. It is said that tests of months' duration, in saline solutions, show that no galvanic action is set up between the solder and the aluminum. Mr. Gronimus' solder has been tested for conductivity, and is said to have 68 per cent. of the conductivity of pure copper. For the aluminum feeders to be used on the Northwestern elevated railroad of Chicago it is proposed to make the joints by using the Gronimus solder in cast-brass sockets, furnished by Mr. J. Lang.

It is said that the new soldering process is cheap and adapted to to the every-day work of electricians.

It is said in York, Pa., that the York Street Electric Railroad company will shortly pass into the control of the Elkins syndicate for $500,000. The bonds and stock of the road amount to $300,000. The road will be extended to Dover, Manchester, Norway Park, York Haven, Goldsboro, New Cumberland, Wrightsville and other points in York County, making a continuous line of electric roads to Harrisburg and Lancaster.

Lightning Conductors.[1]

By Alexander G. McAdie.

Beyond doubt, Franklin proved his case that lightning rods were efficacious in the protection of buildings. Buildings with conductors when struck by lightning suffered little damage compared with those without protectors.

The chief defects likely to occur are blunted points and breaks in the continuity of the connection. The function of a lightning rod is twofold; first, that of conducting the charge to earth, and, second, the prevention of a disruptive discharge by silent neutralization of the cloud electrification. The latter explains why a rod terminates in a point, and likewise why points in good connection with the ground are always desirable upon buildings. Indeed, points are somewhat like small water pipes connected with a large reservoir. If you have enough of them and a sufficient time you may drain the largest reservoir. Furthermore, when some sudden rise or flood occurs in the reservoir, these minute drains may be of service in keeping the height of the water down.

In the case of lightning the points are the small escape pipes, the layer of air between cloud and earth the retaining wall, and the cloud electrification —or charge—the overflowing and destructive element. A large conductor, be it rod or tape, on the other hand, is more like a large main or waterway, which has its gate shut until the flood is imminent. Then the gate is suddenly opened and we try to compel the torrent to keep to the provided path. We trust in its ability to safely hold the flood. Generally it does. In perhaps nine cases out of 10, the lightning conductor, if it be such a one as we will describe later, does carry the flash to earth; but there are cases where the discharges have been heavy and overflows have resulted. To carry the lightning flash "the lightning conductor should offer a line of discharge more nearly perfect and more accessible than any other offered by the materials or contents of the edifice we wish to protect." To prevent the discharge "the conductor should be surrounded by points." These quotations are from the report of the Lightning Rod Conference.

The statement that lightning always follows the path of least resistance, as commonly understood and stated, needs modification. True it is, that when the air is strained by being subjected to the electrifications of cloud and earth, the weakest spot gives way first, and this is apt to be in line with some small elevated knob or surface; but it is equally true, and is perhaps the more general case, that when a really vigorous disruptive discharge does occur, it is somewhat, as Dr. Lodge aptly puts it, like an "avalanche." As a matter of fact, we find from the study of actual cases where buildings have been struck, that lightning often disregards entirely metallic surfaces and points. What we should first know is, whether the condition is to be one of "steady strain"[2] or "impulsive rush"[2] discharge. In the case of "steady strain," the metal is apt to influence the path of discharge; in the case of an "impulsive-rush" discharge, even points seem to lose their efficiency and become of little use.

In a letter[3] of an old British admiral there occurs a description of his being called upon to approve some specifications for a lightning conductor to be erected on a certain lighthouse. He was himself a believer in the "surface" theory of Harris; but

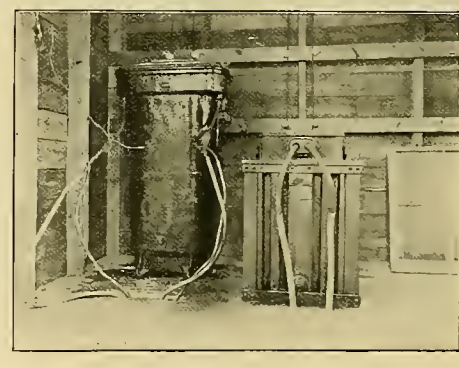


FIG. 7. ELECTRICAL HEATING AND COOKING AT THE CARMELITE HOSPICE.—TRANSFORMERS.

thought that, to make sure, he would go and consult his friend Faraday. Faraday, who saw only the question of conductivity in the problem, said very positively that the solid rod was better than the tube (which gives greater surface with less copper), and that solid volume was everything, superficial area nothing. Moreover, if Harris says otherwise, "then, he knows nothing whatever about it." The admiral straightway approved the solid-rod conductor for the lighthouse. Within two or three days he met Harris, and bringing up the question, was told by Harris "surface area is most important, and if Faraday says otherwise, then he knows nothing whatever about it."

1. Part of a bulletin, "Lightning and the Electricity of the Air," prepared under the direction of Willis L. Moore, chief of the United States Weather Bureau.

2. Terms used by Professor Lodge.

3. See report of Lightning Rod Conference.

Up to a certain point Faraday was right; a copper rod an inch thick is capable of carrying almost any flash of lightning, and is undoubtedly a great protector, but if, as we have reason to believe, the core is seldom given a chance to carry the current, why have it? The views of Sir W. Snow Harris, based as they were upon close study of many thousand cases of lightning action, are finding in the experiments of to-day the confirmation so long needed.

While not going into details regarding this question of the shape of the rod, let us emphasize the fact, so recently brought out, that if an electric current flows steadily in one direction in a cylindrical wire, its intensity is the same in all portions of the wire, as shown by Hertz, but that with a current of an oscillatory character, i. e., a current which rapidly reverses its direction, this condition no longer holds, and if the direction is altered very rapidly the interior of the wire, in our case the lightning rod, may be almost free from current.

In 1882 appeared the report of the Lightning Rod Conference, in many respects the most important contribution to the literature of the subject yet made. While so many foreign governments, and in particular France, had by means of officially constituted boards taken a governmental interest in the protection of the people from the dangers of lightning, the English-speaking people of the world, aside from the few directions officially issued for the protection of magazines and lighthouses, remained without any authoritative utterance upon the subject; and while this conference itself did not have strictly official

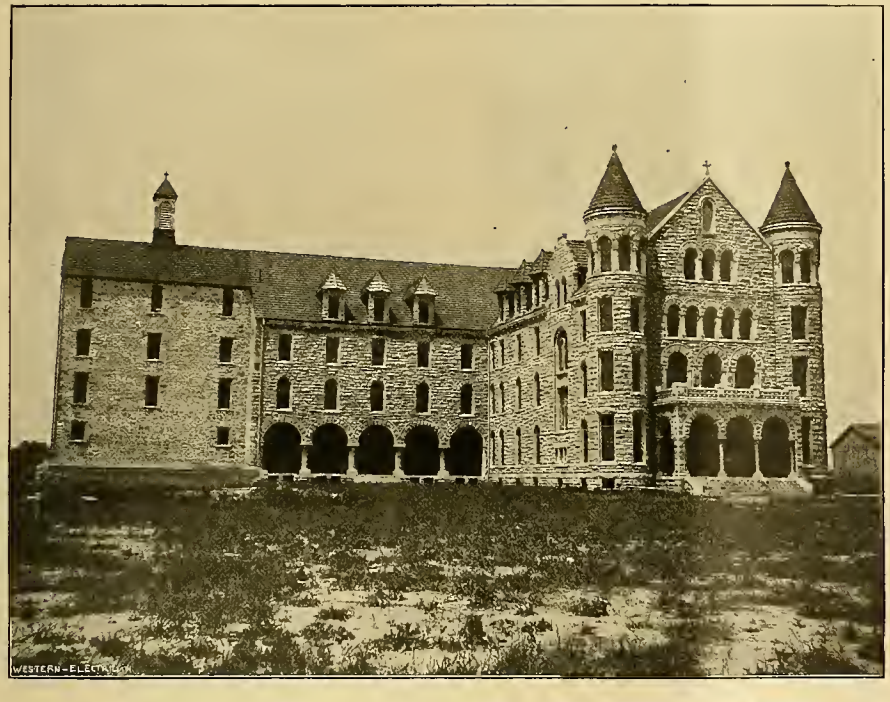


FIG. 5. ELECTRICAL HEATING AND COOKING AT THE CARMELITE HOSPICE.—NEW BUILDING.

sanction, it carries, from the character of its makeup, a weight certainly as great, if not greater, than an official board. It was simply a joint committee of representative members of the Institute of British Architects, the Physical society, the Society of Telegraph Engineers and Electricians, the Meteorological society, and two co-opted members. As might be anticipated from such auspices, the report is an excellent one, and must stand for years as the embodiment of the most widely gathered information and well-considered decisions. The report is emphatically one based upon experience.

The famous free-for-all discussion which occurred at the British Association meeting in 1888, so far as our judgment goes, simply proved that the decisions of the conference could not at present be disregarded. As the president of the meeting, Sir William Thomson, said, "we have very strong reason to feel that there is a very comfortable degree of security, if not of absolute safety, given to us by lightning conductors made according to the present and orthodox rules."

There are one or two further features to which attention may be called. There are some very prevalent misapprehensions with regard to lightning. For example: That it never strikes twice in the same place; that the most exposed place is always struck; that a few inches of glass or a few feet of air will serve as a competent insulator to bar the progress of a flash that has forced its way through a thousand feet of air, etc. These are alluded to in the following general directions:

ERECTION OF RODS.—GENERAL DIRECTIONS.

1. Few questions have been so thoroughly discussed from practical as well as theoretical standpoints as that of the certainty of the protection afforded by properly constructed lightning rods. All barns and exposed buildings should have lightning rods. Ordinary dwelling-houses in city blocks have not the need for rods that scattered houses in the country, and especially if on hillsides, have.

2. Use a good iron or copper conductor. If the latter, one weighing about six ounces to the foot, and preferably in the form of tape. If iron is used, and it seems to be in every way as efficient as copper, have it in rod or tape form and weighing about 35 ounces to the foot. "A sheet of copper constitutes a conductive path for the discharge from a lightning stroke much less impeded by self-induction than the same quantity of copper in a more condensed form, whether tabular or solid."—(Sir William Thomson.)

3. The nature of the locality will determine to a great degree the need of a rod. Places apart but a few miles will differ greatly in the relative frequency of flashes. In some localities the erection of a rod is imperative; in others, hardly necessary.

4. The very best ground you can get is, after all, for some flashes but a very poor one; therefore, do not imagine that you can overdo the matter in the making of a good ground. For a great many flashes an ordinary ground suffices, but the small resistance of .1 ohm for an intense oscillatory flash may be dangerous. Bury the earth plates in damp earth or running water.

5. "If the conductor at any part of the course goes near water or gas-mains, it is best to connect it to them. Wherever one metal ramification approaches another, it is best to connect them metallically. The neighborhood of small-bore fusible gas-pipes and indoor gas-pipes in general should be avoided."—(Lodge.)

6. The top of the rod should be plated or in some way protected from corrosion and rust.

7. Independent grounds are preferable to water and gas-mains.

8. Clusters of points or groups of two or three along the ridge rod are recommended.

9. Chain or linked conductors are of little use.

10. Area of protection. Very little faith is to be placed in the so-called area of protection. The committee that first gave authority to this belief considered that the area protected by any one rod was one with a radius equal to twice the height of the conductor from the ground. Many lightning-rod manufacturers consider that the rod protects an area of radius equal to the height. The truth is that buildings are struck sometimes within this very area, and we now hold there is no such thing as a definite protected area.

11. Return shock. Some uncertainty exists on this point. The so-called "return stroke" is caused by the inductive action of the charged cloud on bodies within its influence, and yet some distance away from the place of the direct discharge. As explained by Lord Mahon, who first called attention thereto, the sudden return of the body charged inductively to a neutral condition, following the equalization at some distant place, is the cause of the return shock. We are beginning, however, to see more clearly into the character of the stress in the dielectric, preceding and during flashes, and it is only a question of time before the use of this term, "return shock," will be abandoned. Of far greater import are the terms "recoil kick" and "alternate path," as shown experimentally by Lodge to exist.

12. Upward motion of stroke. There is no reason to doubt that the discharge takes place sometimes from earth to cloud. That is to say, that while we now consider a lightning flash as something like the discharge of a condenser through its own dielectric, made up of excessively frequent alternations, say something like 300,000 times per second, the spark or core of incandescent air may seem to have had its beginning at the earth's surface. That is to say, the air-gap breaks down first at a point near the earth.

13. Indifference of lightning to the path of least resistance. Nearly all treatises upon lightning, up to within very recent times, assumed that lightning always followed the path of least resistance. "It is simply hopeless to pretend to be able," says Lodge, "to make the lightning conductor so much the easier path that all others are out of the question." The path will depend largely upon the character of the flash.

14. Any part of a building, if the flash be of a certain character, may be struck, whether there is a rod on the building or not. Fortunately, these are exceptional instances. The great majority of flashes in our latitudes are not so intense but that a good lightning rod, well earthed, makes the most natural path for the flash. We have many instances, however (not to be confounded with cases of defective rods), where edifices, seemingly well protected, have been struck below the rods.

15. Paradox of paradoxes, a building may be seriously damaged by lightning without having been struck at all. Take the famous Hotel de Ville of Brussels. This building was so well protected that scientific men pronounced it the best protected building in the world against lightning. Yet it was damaged by fire caused by a small induced spark near escaping gas. During the thunderstorm, some one flash started "surgings" in a piece of metal not connected in any way with the protective train of metal. The building probably did not receive even a side flash. This is, therefore, a new source of danger from within, and but emphasizes the necessity of connecting metal with the rod system.

16. Lightning does sometimes strike twice in the same place. Whoever studies the effects of lightning's action, especially severe cases, is almost tempted to remark that there is often but little left for the lightning to strike again. No good reason is known why a place that has once been struck may not be struck again. There are many cases on record supporting the assertion.

17. As lightning often falls indiscriminately upon tree, rock or building, it will make but little difference sometimes whether trees are higher than adjoining buildings.

18. It is not judicious to stand under trees during thunderstorms, in the doorway of barns, close to cattle or near chimneys and fireplaces. On the other hand, there is not much sense in going to bed or trying to insulate oneself in feather beds. Small articles of steel, also, do not have the power to attract lightning, as it is popularly put, or determine the path of discharge.

19. Unnecessary alarm. Just in advance of thunderstorms, whether because of the varying electrical potential of the air, or of the changing conditions of temperature, humidity and pressure, and failure of the nervous organization to respond quickly, or to whatever cause it may be due, it cannot be denied that there is much suffering from depression, etc., at these times. It is, perhaps, possible that these sufferings may be alleviated. Apart from this, many people suffer greatly from alarm during the prevalence of thunderstorms, somewhat unnecessarily, we think. Grant even that the lightning is going to strike close in your vicinity. There are many flashes that are of less intensity than we imagine—discharges that the human body could withstand without permanent serious effects. Voltaire's caustic witticism, "that there are some great lords which it does not do to approach too closely, and lightning is one of these," needs a little revision in these days of high-potential oscillatory currents. Indeed, the other saying, "Heaven has more thunders to alarm than thunderbolts to punish," has just so much more point to it, as it is nearer the truth. One who lives to see the lightning flash need not concern himself much about the possibility of personal injury from that flash.

20. Finally, if you should be in the vicinity of a person who has just been struck by lightning, no matter if the person struck appears to be dead, go to work at once and try to restore consciousness. There are many cases on record proving the wisdom of this course, and there is reason for believing that lightning often brings about suspended animation rather than somatic death. Try to stimulate the respiration and circulation. Do not cease in the effort to restore animation in less than one hour's time. For an excellent illustration of a case of severe lightning shock and recovery, due, it would seem, to prompt action by the medical gentlemen present, all who are interested may consult the Medical News, August 11, 1888. A number of cases corroborative of this view are on record in various medical journals.

No matter which method for respiration you use, it is important to maintain the warmth of the body, by the application of hot flannels, bottles of hot water, hot bricks, warm clothing taken from bystanders, etc.

Firmly and energetically rub the limbs upward so as to force the blood to the heart and brain. If an assistant is present, let him attend to this. Remember above all things that nothing must interrupt your efforts to restore breathing.

When swallowing is established a teaspoonful of warm water, wine, diluted whisky or brandy, or

warm coffee should be given. Sleep should be encouraged. In brief:

1. Make the subject breathe by artificially imitating the respiratory movements of the chest.
2. Keep body warm.
3. Send for a physician.

Of the visible effects of lightning stroke upon the human body little more can be said than that sometimes burns, usually superficial, have been noticed, frequently red lines or markings, which are localized congestions of the small blood vessels of the skin. These, from their irregularities and branchings, have led to the fanciful idea of photographs of trees, etc.

In conclusion, it may be said that lightning frequently causes a temporary paralysis of the respiration and heart beat, which, if left alone, will deepen into death, but intelligently treated, will generally result in recovery.

Three-cent Fares Withdrawn in Detroit.

"The street-car fight in Detroit is developing so many new features daily that it is almost impossible to keep up with the record," says a Detroit correspondent of the Western Electrician, writing on Saturday last. "At four o'clock yesterday morning the brief enjoyment by Detroiters of three-cent fares and universal transfers came to a quick end by means of special instructions from Superintendent Du Pont of the Citizens' company, acting under orders from Tom Johnson, who is at present away attending to the strike in Brooklyn.

"Through a curious oversight on part of the company, however, Detroiters have been enabled to pay three-cent fares and get transfers on five-cent straight lines, thereby keeping the three-cent system still in vogue, to a large extent. As the three-cent lines of the old Detroit railway are pledged in their charters to maintain that rate or forfeit franchises, the situation here is not without its ludicrous side.

"Furthermore, the citizens are now generally seeking revenge for Johnson's attempted introduction of the five-cent straight rate. Already action has been taken to harass the five-cent roads as much as possible. The points of attack will be special and unauthorized turnouts, spur tracks, side tracks and freight privileges, the last-named having grown to be a profitable business, although wholly unwarranted by the charters of the five-cent roads. Mayor Maybury has been asked to lead the citizens' fight for revenge."

The resolutions adopted at a special meeting of the Common Council on July 22d were as follows:

Whereas, After six days' experimenting with three-cent fares, the owners of the street-railway lines of this city have issued an order requiring a straight five-cent fare on the Citizens' and Fort Wayne lines, with universal transfers, with the evident intention of intimidating the people of Detroit, and to force them into a weak compliance with the scheme to buy their lines at the exorbitant price of $17,500,000, with the alternative of a 48-year six-for-a-quarter franchise; and,

Whereas, The street-railway companies of Detroit have enjoyed many privileges not included in their franchises during the time they sold six tickets for a quarter, which would not have been granted had the companies expressed any intention of exacting the full price allowed by their franchises; now, therefore, be it

Resolved, By the Common Council of the city of Detroit, in extraordinary session assembled, that it is the sense of this body that such action in increasing the fares to a straight five-cent basis is an unwarranted act of bad faith on the part of the railroads and is in violation of law.

Resolved, That the corporation counsel be and is hereby directed to immediately institute the proper legal proceedings to test the legality of the order issued by the Citizens' and Fort Wayne street-railway companies, requiring a straight five-cent fare on the lines of those companies.

An ordinance has been passed in South Pasadena, Cal., granting special privileges to the Edison Electrical company of Los Angeles, to erect poles and string wires along the public streets and alleys of the city for the purpose of conducting electricity for use in furnishing light, heat and motive power.

Boardman River Power Transmission.

Some time ago the Western Electrician published an account of the plant of the Boardman River Electric Light and Power company, operating at Traverse City, Mich. Since that publication the plant has grown considerably, new machinery has been added, and better service has been provided for the customers.

The power is derived from the waters of the Boardman River, one of the swiftest streams in Michigan, and transmitted by means of a three-phase transmission line to Traverse City, a distance of nearly five miles. The power house is situated on the west side of the river, at a place very advantageously located for the easy development of the water power. The river banks are so shaped and situated that it was only necessary to build a comparatively short dam to obtain the desired head for operating the water-wheels. The dam, as constructed, is 700 feet long, 175 feet wide at its base and 30 feet wide at the crest. It is 24 feet in height and the depth of water is about 20 feet. The chute is 210 feet long and 30 feet wide, and it is estimated that 30,000 cubic feet of water a minute will always be available.

FIG. 1. BOARDMAN RIVER POWER TRANSMISSION.—DYNAMO ROOM.

A canal leads to the power house and furnishes the water under a 15-foot head to the water-wheels. At present about 600 horse power is used, but 1,200 horse power is available at the dam.

The wheel room occupies the lower floor of the building and contains one 45-inch Samson turbine, built by James Leffel & Co., and one 44-inch Trump turbine, from the Trump Manufacturing company. These turbines are rated at 250 horse power each and are connected by 34-inch belts to a jack-shaft on the second floor. This shaft, running the whole length of the building, is provided with friction clutches of the Hill and Medart patterns, and is connected by belting to the generators on the floor above.

Fig. 1 shows the dynamo room, with an addition on the left which contains a 150-kilowatt General Electric three-phase generator, recently installed. There are also two 60-kilowatt General Electric three-phase generators, only one of which shows in the illustration. All three alternators are separately excited. Two 50-light Thomson-Houston arc machines supply two arc-light circuits for public and private lighting in the city. The switchboard shown on the right of the picture is supplied with the necessary ammeters, voltmeters, regulators, switches and circuit-breakers.

The current is generated at 2,500 volts and is transmitted to the city over three No. 1 copper wires. The arc-lighting circuits are carried over four No. 6 copper wires, the circuits dividing at the edge of the city. Fig. 2 gives a good view of a piece of the pole line and of the country through which it passes. A private telephone line strung on the lower cross-arms connects the power house with the office of the company in Traverse City.

In the city step-down transformers are used to reduce the pressure from 2,500 to 230, 115 or 52 volts, as the service demands. Two 15-kilowatt General Electric type H transformers on poles, at the center of distribution, are shown in Fig. 3. Over 90 transformers of the types F and H are in use in different parts of the city. The current is used all over the city for incandescent-lamp service, supplying power for three-phase motors and for heating sad-irons and other domestic uses. The plant has been in steady operation for some years, giving a 24-hour service. The working of the entire system has been very satisfactory. The stock of the company, which is capitalized at $100,000, is owned by local business men. The company's officers are: President, William Loudon; vice-president, Ed Greilick; secretary, A. V. Friedrich; treasurer, S. Garland; superintendent, William Love.

FIG. 2. BOARDMAN RIVER POWER TRANSMISSION.—POLE LINE.

Electricity in a Gas Plant.[1]

By H. G. Field.

At first thought it might well be treated as a joke to suggest the use of electric lights to illuminate the works of a gas generating and supply company. On the contrary, electric lighting may be used in such a plant to great advantage. The writer has recently planned and supervised the installation of a small electric plant for lighting the works at Station A of the Detroit City Gas company. A brief description of this equipment and its special utility may prove interesting.

The dynamo is a Crocker-Wheeler bipolar belted machine, with a rated capacity of 40 amperes at 125 volts. It is driven by a White & Middleton gas engine, rated at nine brake horse power. This engine furnishes power from its main belt pulley to drive a line shaft, from which are belted various machines, such as drill presses, lathes and blowers for general shop and forge purposes. An auxiliary belt pulley is belted to the other flywheel to drive a countershaft, from which the dynamo is belted. The countershaft is provided with tight and loose pulleys, to allow the dynamo to be run or remain idle, as desired. A flywheel is attached to this countershaft to assist in maintaining the dynamo at constant speed.

The marble switchboard contains an ammeter and a voltmeter of the Weston round pattern, a field rheostat for dynamo, a Fisher single-pole vertical-operating circuit-breaker, voltmeter and ground-detector switches, pilot and instrument lamps, and switches for controlling the various feeders, all protected by fuses.

The buildings and portions of the grounds lighted are principally such as would prove dangerous on account of possible explosions if lighted by gas or exposed to flame. The feeders run mainly outside of the buildings and supply current at various distributing centers to a total of about 100 lamps, of from four to 32 candle power. At the centers of distribution are cabinets which contain cut-outs with fuses to protect the various circuits. Especial care was taken to carefully seal all openings leading from

1. From The Technic, University of Michigan.

these cut-out cabinets into rooms where danger might arise from gas explosion resulting from the blowing of a fuse, and these cabinets are ventilated into the open air.

The dangerous departments include the Pintsch compressor room and tankhouse, the natural, coal and water-gas purifier cellars and ground-floor rooms, and the ammonia room. To avoid sparks in these rooms, keyless sockets are used, and the lights are operated by switches outside, either pro-

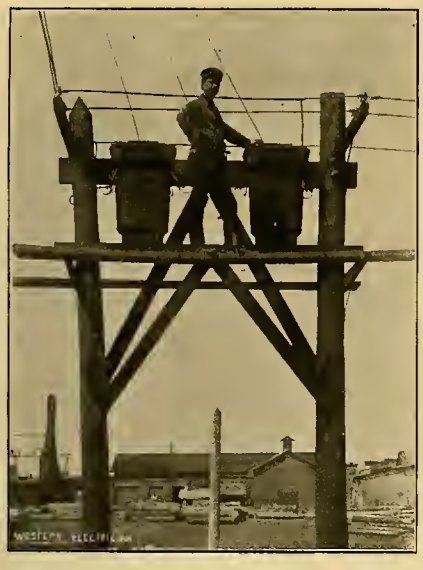


FIG. 3. BOARDMAN RIVER POWER TRANSMISSION.—TRANSFORMERS AT CENTER OF DISTRIBUTION.

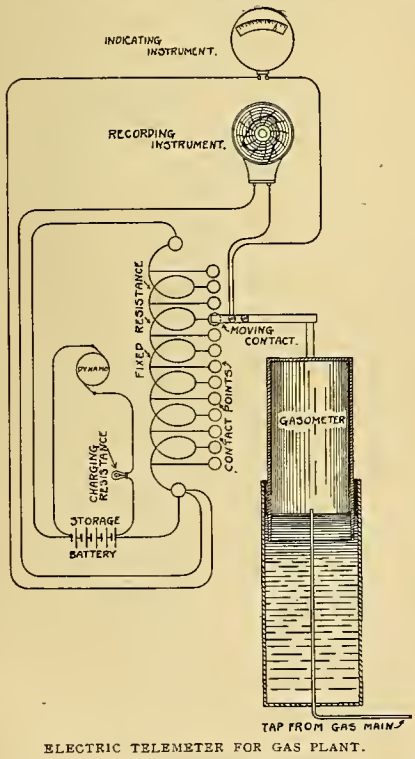
vided with special waterproof boxes or placed inside of cabinets.

The inside wiring is mostly of the exposed or open character, except where subject to injury by employes, in which cases molding is used to protect the wires.

Long extension cords, with rubber, jute and cotton covering, and provided with waterproof sockets and heavy lamp guards, are used for portables to facilitate inspection in case of trouble in tanks, purifiers, valves or inaccessible appliances.

Where it was formerly necessary to work in the dark in case of gas leakage in any department, it is now possible to turn on electric lights from without, enter and make repairs by the aid of electric light and without danger from explosions.

As auxiliary electrical equipment may be men-



ELECTRIC TELEMETER FOR GAS PLANT.

tioned a storage battery of three cells of type D 7 chloride accumulators used in connection with a spark coil for the gas-engine igniter in starting up. This battery also serves to operate an electric counter located in the coal-gas generator room. This counter is connected with the large main meter near the offices and registers, in view of the operators, the amount of gas passing through the meter.

An electric-telephone system, with seven instruments, furnishes an easy means for the superintendent to communicate with the various departments. Some difficulty was found at first, due to coke and coal dust which collected on top of the magneto boxes and short-circuited the electrical contacts. Covers were afterward provided for these contacts, thus effectually stopping the trouble.

A new and somewhat novel electrical device for indicating at the works the exact gas pressure in the street mains, at the office building, over two miles away, has been in successful service for the past four months. It was invented and designed for this special service, and a patent has been applied for to cover its application to indicating or recording at a distance any pressures, positions, volumes or changes of pressure or position. The application may be made equally well to steam or any vapor, gas or solid.

The indicating instrument consists of a voltmeter to measure the drop of potential over a circuit of practically fixed resistance, over which a current of constant value is passing. The current is provided by a storage battery, and is maintained constant by being continuously charged by current from a dynamo. The current from the dynamo is regulated by lamp or other resistance, so that the charging current is just enough in excess of the battery current to provide for the loss in the battery according to its efficiency. A sliding contact is attached to the bell of a gasometer at the gas office. This sliding contact connects with the various segments of a commutator connected at frequent points on the resistance coil. These points are spaced uniformly with respect to the drop in potential. As the contact point moves up or down, due to increase or decrease of pressure in the gasometer, the drop in potential is greater or less, and is so indicated on the voltmeter at the gas works. The voltmeter is calibrated to read in terms of gas pressure, as so many inches of water head. The accompanying diagram illustrates the connections and circuits as applied to both an indicating and a recording voltmeter.

In addition to these applications of electricity in a gas plant, it is now proposed to operate in the basement of the office building of the gas company another dynamo, directly connected to a small engine, to be likewise operated by natural gas. This is to be an exhibition plant, to illustrate the possibilities of using natural gas to advantage in driving dynamos for light and power. Current will be supplied to several incandescent lamps to illuminate the exhibit, to arc lamps and to a motor, which will operate a pipe-cutting machine, a drill press, an emery wheel, a grindstone and an exhaust fan to ventilate the meter-testing and repair department. A dozen or more electric fans to ventilate and cool the offices will also be run by current from this same dynamo.

The possibilities of such plants on a good commercial basis are increasing rapidly, with the many improvements in the manufacture of close-regulating gas engines, and especially at the existing low rates for natural gas. The cost of operation for such plants is so low that the gas company claims that with water gas at more than double the present price of natural gas, the cost of operation would still allow a good margin to compete with steam plants using coal for fuel.

The Fire at Como.

It is announced that upon the site of the electrical exposition building at Como, totally destroyed by fire on July 8th, new galleries are to be built at once, and the opening of the resuscitated exhibition is fixed for August 15th. Among the curios saved from the fire is one of Volta's piles—probably the earliest, says the London Electrician—which belongs to the Civic Museum at Como. There have also been rescued 20 manuscripts, including two passports and some diplomas; also a few letters of Volta's, 29 books from Volta's library and 52 pictures, engravings, diplomas, medals, etc. Unfortunately, Volta's condensing electroscope and all his laboratory notes and scientific correspondence are lost. Among the interesting electrical exhibits, not directly associated with Volta, were a number of Ferraris' models and some of his manuscripts and diplomas. These have been saved, with the exception of the first model of the rotatory field, which was destroyed.

It has been decided not to abandon the arrangements for a worthy celebration of the actual centenary next September, when an international conference of scientists will be held and elaborate fêtes are to celebrate the name of Volta.

Lightning and Toothache.

Detroit, July 22.—The following curious instance of the "superstitions of electricity," if the term may be used, came to light in this city immediately after a bolt of lightning had struck Stephen Baldwin's house, in the heart of the town. A mail carrier who happened to be close to the scene was knocked down and stunned by the force of the shock. When he regained his scattered senses he picked up a stick of wood fresh from the dismantled barn across the street and put it in his mail sack. "It will all be made into toothpicks," he said, "as those articles made from wood that has been struck by lightning are a sovereign cure for toothache." J. H. G.

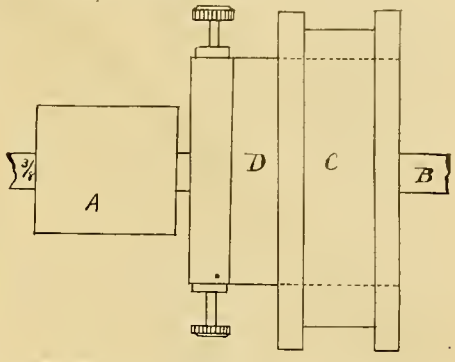
A Home-made Alternator.

By B. F. Fells.

Some time ago I described in the Western Electrician the construction of a home-made alternator. Some of the readers of the article started to build the machine, and I have been asked for further information as to voltage, size of wire for field and armature windings and the construction of the hub of the armature. For the benefit of all who may be interested, I shall answer very briefly the questions put to me:

The plans are for producing a single-phase, alternating-current machine at 110 volts pressure when run at about 1,800 revolution per minute, if the fields are strongly magnetized.

As to winding the field with No. 22 wire and the



A HOME-MADE ALTERNATOR.—DETAIL OF BEARING.

armature with No. 20 wire, or the former with No. 20 wire and the latter with No. 18 wire, I may say that the capacity might be raised some if the latter method be employed.

For a more detailed description of the bearing, the reader is referred to the accompanying drawing, in which the steel shaft is indicated at (B), the brass hub for the armature (A), the wood hub (D), and the rings (C). The wood hub should be turned 2¼ inches in diameter at the smallest part and three-fourths inch between flanges. The rings are cut from seamless brass tubing.

Australian Race-track Electrically Lighted.

The illustration, reproduced from the Electrical Review of London, shows the lighting of the cycle track at Sydney, Australia. There are altogether 55 arc lamps and 70 incandescents, of which 45 arcs of 2,000 candle power each are placed around the track at intervals of 35 feet, the lamps being inverted with the reflectors immediately over the arc. The grand and ladies' stands are lighted by incandescent lamps. The arc lamps are run six in series on a 300-volt circuit, and it is said that the lighting is in every way a success, there being no shadows

AUSTRALIAN RACE-TRACK ELECTRICALLY LIGHTED.

on the track. Some of the leading cyclists in the colony have expressed the opinion that, if anything, it is safer to ride by night under this light than by daylight. Since the track has been electrically lighted there have been no accidents upon it.

Violence in Cleveland.

The street-railway strike in Cleveland assumed alarming proportions by the close of last week. The strikers and their sympathizers displayed great bitterness toward the "Big Consolidated" company, and by Saturday night half a thousand militiamen, as well as the entire police force, were patrolling the streets to hold the incipient mobs in check. Cars were stoned, non-union men were jeered at and in some cases wounded, and feed wires were cut. A Euclid avenue car filled with passengers was wrecked by an explosion of nitroglycerin or guncotton, shortly before 11 p. m. on Sunday, July 23d. Four passengers were badly hurt. There were several cases of rioting on Sunday, with the result that a number of men on both sides sustained more or less severe injuries and many were arrested. The company declines to submit the difficulties to arbitration.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:
Suite 510 Marquette Building, CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition to Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

Chicago Exposition of Electrical Arts, Tattersall's, September 25th to October 9th.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

Strikes are very unsatisfactory and unenlightened methods of settling labor disputes, whatever the merits of the controversy or whoever the victor. This is true when the strikers are men, often with families, who are driven to desperation by real or fancied grievances. But when the strike is organized by boys, like telegraph messengers, whose places can be filled with little difficulty, the idea is carried to a ridiculous extreme. Such strikes are reported in New York and Cincinnati, and are, of course, doomed to failure. The companies may be put to temporary inconvenience in delivering messages, but will soon have a new force of messengers, and the last estate of the ill-advised boy strikers will be worse than the first. Possibly, the messengers had just cause of complaint, but they adopted a foolish and necessarily ineffectual method to redress their difficulty and have bought a dear lesson of experience early in life.

American electrical engineers are often moved to impatience in considering the conservative methods of the Navy Department at Washington in refusing to adopt for general use electrical power applications that have seemingly stood all reasonable tests in actual service. Yet, when compared with other navies, the American service is decidedly advanced and progressive in the use of electricity. This fact was well illustrated in a recent debate in the British House of Commons, in which Mr. Goschen, the first lord of the admiralty, said: "Both the United States and Japan are now naval powers sufficiently important to make us think we ought to have a naval attache in those countries. As attache to the embassy at Washington we are going to appoint an officer especially competent to deal with electrical matters." This shows the reputation of the American navy abroad. Electrically, it is not without honor save in its own country.

The expressions of the sympathy of electrical men with their Italian confrères on the loss of the Volta relics by the fire at Como have been many and sincere. Professor J. A. Fleming writes to the London Electrician: "The calamitous fire at the Electrical Exhibition of Como which has destroyed all, or nearly all, of the invaluable historical apparatus of Volta, is something more than a national disaster. The preservation of the tools with which great workers have worked is in all cases a most desirable thing in the interests of scientific history, but to lose at one stroke the whole handiwork of a master on the year of the centenary of his great discoveries is tragedy of which we have no previous experience. The great fire of London swallowed up, I believe, the Magnetic Terrellæ of Gilbert, but the instruments of Galileo and Newton, Faraday and Davy still fortunately survive. It is easy to be wise after the event, but this loss shows the risk incurred in gathering into a single inflammable building all the existing memorials of one celebrity." Professor Fleming suggests that an official declaration of sympathy by the Institution of Electrical Engineers be prepared and conveyed to the president of the gathering at Como on September 18th in honor of the Volta centenary. The idea is a good one and may well be adopted by the American Institute of Electrical Engineers also.

In forecasting the future of the automobile it has been generally taken for granted that the gasoline-propelled vehicle was the one for cross-country touring, while the electric carriage was best adapted for smooth city pavements. But in actual test on country roads the gasoline motocycle has not done as well as expected. Here is the transcontinental trip of Mr. and Mrs. Davis, for instance. They left New York on July 13th, amid great enthusiasm, bound for San Francisco. Yet on July 23d, 10 days later, they had only reached Syracuse, N. Y., about 300 miles from their starting point. Instead of averaging 15 miles an hour, they had made 30 miles a day. One breakdown succeeded another with discouraging regularity. Mrs. Davis is chronicling the the trip, and when Syracuse was reached she was almost ready to give up. She writes that they were stalled just as they entered the business part of the city. "Were I not determined to reach 'Frisco, I should turn back in disgust," she adds. "It was the second break yesterday, the first occurring just as we entered Canastota and causing a delay of an hour. Our machinist repaired it. My patience is exhausted by what seems continual ill-luck, but my courage does not weaken. Instead of having its break patched and spinning along on its way, the automobile still remains in a crippled condition in the Phœnix foundry, where it was hauled by a horse-drawn truck yesterday. The break was more serious than supposed. The front cylinder was badly broken and cracked, necessitating ordering a new one from the factory."

Perhaps an electrically propelled vehicle would have met as many mishaps as the Davis automobile, and it is, of course, true that in crossing the country many stretches would be encountered where it would be difficult—perhaps impossible—to procure the necessary charging current. The bad country roads would be at least as trying to the electric carriage as to the gasoline vehicle, and it is to be remembered that it was an automobile of the latter type that made the 600-mile trip from Cleveland to New York. Still, the electric vehicle would have no cylinders to crack, at any rate, and although it might have troubles of its own, it does seem that the presumed superiority of the gasoline or gas-engine type for country travel may have been much overrated.

Despite their bad luck at the start, Mr. and Mrs. Davis are making a plucky and very interesting experiment. Very likely the chapter of accidents that they have encountered may be only the stormy introduction to a pleasant journey. At least all friends of progress will hope so and rejoice in a successful termination of the long tour.

The incorporation of the British Westinghouse Electric and Manufacturing company of London is an interesting and important event. The new company is capitalized at £1,500,000, and is formed for the purpose of doing a general electrical manufacturing business in England on American lines and by the use of American expert knowledge and American patents. That there is a well-recognized opening for such a concern in Great Britain is not flattering to English pride, but the fact remains, and as "business is business" with the hard-headed Briton as well as the ambitious Yankee, there is no doubt that ample capital will be subscribed.

The new company will have for 10 years the use of the patents and improvements of the Westinghouse Electric and Manufacturing company of Pittsburg for the United Kingdom and all its colonies except Canada and those in the West Indies. George Westinghouse and Lemuel Bannister are on the board of directors and Lord Kelvin is named as technical adviser. The American company agrees to relinquish all business in the British company's territory, including orders on hand, and will supply all apparatus which the new company may require until the factory in England is in working order. This factory will be placed at Trafford Park, Manchester, on a site covering about 40 acres. The American company guarantees that the profits resulting from the business for the first two years shall amount to a sum not less than sufficient to pay the six per cent. dividend upon the preferred stock during that period. The authorized issue of preferred stock, it may be explained, is £1,000,000 and of common stock £500,000. The American company will take all the common stock for its consideration, and the proceeds of the sale of preferred shares will be used for working capital. The contract between the American and British Westinghouse companies, embodying these provisions, was entered into on July 10th.

The scheme has been carefully worked out and will no doubt be attractive to British investors. If the new company is successful, as it should be, it will, of course, close the British market in a few years to American-made Westinghouse apparatus. But the world is wide, and on the whole the effect of the new departure should be stimulating to the electrical industry at large, as the British Westinghouse company will undoubtedly foster an electrical demand that will be of general benefit to all.

Some interesting figures of the business of the American Westinghouse Electric and Manufacturing company are given in the prospectus of the new company. It is stated that the value of the output of its Pittsburg factory for the year ended March 31st last was $7,140,000, on which the net profit was more than $1,275,000, "these figures being subject to final audit." The orders for Westinghouse apparatus in the new company's territory (United Kingdom and colonies, with exceptions noted) for the year ended with June, 1898, are certified to be $650,000, and for the year ended June, 1899, $1,330,000.

Test of Electric Fans.

"A Comparative Test of 12-inch Electric Fans" is the subject of a graduating thesis prepared by Messrs. J. T. Mountain and E. A. Hughes of the engineering department of the University of Michigan. The object of the investigation that formed the basis of the thesis was to determine by tests the relative performance of the latest styles of electric fans that have been placed on the market. Five makes of fans were used, three having direct-current motors, the others using alternating current.

The principal point to be ascertained by the test of each fan was the "gross efficiency." This term was used to indicate the ratio of the useful work actually done by the fan itself to the work expended upon the motor in the same time. The work expended was measured by ordinary methods, care being taken to reduce the readings to the same basis. To obtain the useful work accomplished the volume of air displaced per minute was measured by means of a large air-tight rectangular box, the fan discharging into one end through a 12-inch circular opening, the volume of air discharged being measured at the opposite end as it issued through a 17-inch circular opening. The measurement was effected by dividing the outlet into eight imaginary zones and obtaining the average velocity of the air in each zone by means of a calibrated anemometer. "Knowing the area of the zone in square feet and the velocity of the air in feet per minute," say the authors, "it was only necessary to multiply each zone area by the velocity and sum the products thus obtained to find the total volume of air displaced in cubic feet per minute."

The following table gives the results obtained from the different tests:

Number Designating Fan.	Kind of Motor.	Gross Efficiency.	Weight of Air Moved per Second per Watt Input
		Per Cent.	Pounds.
No. 1.....	Direct current	33.35	0.0374
No. 2..	Direct current	21.06	0.0229
No. 3.....	Direct current	19.70	0.0211
No. 4.....	Alternating current	14.40	0.0171
No. 5.....	Alternating current	9.37	0.0154

In conclusion the writers state: "From the above data it is easily seen that the direct-current fans are much more efficient than the alternating-current fans. These tests also show that the old style of fan (straight blades) has a higher efficiency than the new style (curved blades). The old-style fan, when running at 1,700 revolutions per minute, delivered 944 cubic feet of air per minute, while one of the new-style fans, running at the same speed, displaced only 844 cubic feet of air per minute. The rise in temperature of the direct-current fans was very small, but that of the alternating fans was considerable."

New Arrangement for Developing Niagara Power on Canadian Side.

The Ontario government, on July 18th, ratified the new agreement with the Canadian Niagara Power company. Under this agreement the monopoly clauses contained in the old agreement of 1892 are canceled, and an entirely new tariff has been fixed in respect to rental. The direct result will be that other companies, organized with a view to the development of electrical power at the Falls and hitherto restrained by the monopoly clauses, will now be enabled to enter the field. Under the old agreement the company was given the entire monopoly of the water power for practically 100 years at a rental of $25,000 a year for the first 10 years, afterward gradually increasing to $35,000 a year. The company not having complied with certain obligations, an act was passed at the last session of the Ontario Legislature, authorizing the government to negotiate with the company for the rescinding of the monopoly clauses, so as to allow of agreements being made with other companies, which, to the number of six, desired privileges of almost equal extent within Queen Victoria and Niagara Falls Park and above the Falls. To this end negotiations were carried on for some time, and, as stated, an agreement has now been reached.

Under the terms of this new agreement, the company must immediately proceed with the construction of its works, and have completed by July 1, 1903, water connections for the development of 25,000 horse power, and 10,000 horse power ready for actual use, supply and transmission. Instead of a lump-sum rental, as heretofore, the company is to pay a minimum of $15,000 per annum, and in addition thereto at the rate of $1 per annum for each electrical horse power generated, used or sold up to 20,000 horse power; 75 cents for each additional horse power between that number and 30,000 horse power, and 50 cents for each horse power over 30,000 horse power. The company will so construct its works that betweeen 100,000 and 200,000 horse power may be generated, according to the plant. The agreement is to remain in force for 50 years, renewable for two further periods of 20 years each, and the rentals, in the event of the government not demanding a change, to remain as fixed at the present.

The agreement further provides that during the construction of the works the company may enter into an agreement to generate electricity from the plant of the Niagara Falls Park and River Railway company, for drilling and other purposes. Express provision is made that the company shall not amalgamate with any other corporation or company without consent of the government, nor enter into any arrangement for the purpose of pooling their receipts or keeping up the price of power. The company, in the meantime, proposes to supply from the railway power house as much electrical energy as it can dispose of to manufacturers and others on the Canadian side, and to this end the railway power house will be enlarged as quickly as possible and the necessary machinery placed in position.

British Transpacific-cable Project.

[From the Canadian correspondent of the Western Electrician.]

The Pacific cable project is about to be realized. Official dispatches to the Dominion government confirm the report that the imperial authorities have decided to agree substantially with the proposition of the Canadian and Australian governments. The British government is now to become a party to the scheme on the basis of an imperial contribution of five-eighteenths, a contribution of five-eighteenths from Canada, and the remaining eight-eighteenths from New South Wales, Victoria, Queensland and New Zealand, in the proportion of two-eighteenths each. The announcement is hailed with general satisfaction in Ottawa, as it makes possible the carrying out the government's resolution, introduced during the early days of the present session of the Dominion Parliament, empowering Canada to become party to the arrangement for construction and joint state maintenance and control of an all-British Pacific cable from Vancouver, B. C., to Norfolk Island, and with branches from that point to New Zealand and Queensland, on the above basis of contribution.

That it was at one time planned to have the cable touch at Hawaii is a matter of record, as is also the fact that the British plans were forestalled by the action of the then provisional government at Honolulu. This is said to have been brought about by a peculiar circumstance. When, after the visit of the Canadian commissioners, Sir Mackenzie Bowell and Sir Sandford Fleming, to Australia in 1893, the idea of a Pacific cable began to take practical shape, the importance of making a land break in the cable somewhere about Hawaii was realized by both emissaries, and they at once asked for and received sanction of the scheme to take possession, in the name of the queen, of Neckar Islet, one of the outlying islands of the Hawaiian group. The plan was confided to a certain Australian premier, then in Ottawa, on his way home from England across the continent. And it is said that upon his arrival at Honolulu, his promise of reticence broke down under the burden of the secret and he managed to acquaint one of the officials there of the plan. The result was that President Dole at once dispatched a steam launch to Neckar to take possession in the name of the provisional government. When Sir Sandford Fleming's agent arrived at Honolulu to carry out the scheme of hoisting the Union Jack on the proposed cable-landing station, he learned, to his chagrin, that he had been forestalled and that a few days previously the Hawaiian flag had been formally hoisted on Neckar Island. From that time all notion of laying the cable via the Hawaiian Islands has been abandoned, and all estimates of cost, etc., have ever since been based on a landing at Fanning Island, a route which, while increasing the length of the first section to 3,500 miles, preserves the scheme of an "all-British" line.

Passing of the Excelsior Electric Company.

A well-known name is soon to disappear from the list of electrical manufacturing companies. The New York Sun of July 19th says that Charles E. Dustin has been appointed temporary receiver for the Excelsior Electric company, whose office is at 115 Broadway, New York, in proceedings for the voluntary dissolution of the corporation. It is stated that the company has no available funds to pay its debts or carry on the business, and is unable to procure any money for that purpose. The total liabilities are $230,621. The assets consist of machines, tools, patterns, materials, etc., $46,903 nominal value; office furniture and 55 patents, the value of which is not given in the schedules. Most of the machines, tools and patterns are said to be obsolete. The company was incorporated in August, 1881, with a capital stock of $500,000. In May, 1898, it passed into the control of the General Electric company, which put in Charles E. Dustin as president and treasurer, and which has since controlled it. There are 36 stockholders, the largest being C. T. Hughes, $384,500, and J. N. Smith, Lynn, Mass., $35,300. Bonds for $166,000 were issued on December 31, 1888, secured by a mortgage on its plant and other assets. The receiver is authorized to continue the business to work up the materials on hand at the factory.

Milan, Italy, has an excellent electrical transit service. The total length of track operated is 66 miles. Most of the lines radiate from the Cathedral square, while a belt line encircles the city. The system is divided into sections and the fare for each section is 10 centesimi (two cents). A special rate of five centesimi (one cent) is made for the working and poorer classes for certain periods of the day.

BOOK TABLE.

PRACTICAL ELECTRICITY. WITH QUESTIONS AND ANSWERS. Cleveland: Cleveland Armature Works. 1899. Price, $2.

This little book is especially designed for the large numbers of mechanics and stationary engineers who are called upon to operate electrical machinery without knowing very much of its general construction. It has been written throughout by practical men, who have set forth the general characteristics of batteries, wiring, dynamos, lamps and instruments in a clear and forcible manner. The publishers have had associated with them in the compilation of the work Mr. John C. Lincoln, an electrical engineer, who has contributed articles to the book covering matters of special interest. The principal feature of the book is the review of each chapter. This review is in the form of questions placed at the end of the chapter which thoroughly review the subject and bring out all the important points in the chapter. A key giving the correct answers to all the questions is provided in the back of the book. The book is neatly bound in flexible leather and is of a handy size to carry in the pocket.

MUNICIPAL PUBLIC-SERVICE INDUSTRIES. By Allen Ripley Foote. Chicago: Other Side Publishing Company. 1899. (Pp., viii., 337.)

The subject of this book is one which Mr. Foote has made the study of years, and, as it is a very important subject indeed, whatever he has to say about it is entitled to respectful consideration. In the present volume the author has collected three of his contributions to the discussion of the best method of operating and controlling public-service utilities. The first of these papers, "How Should the Franchise Question be Settled?" is the latest in time of delivery and perhaps the most important, as in it Mr. Foote makes a definite attempt to answer the question expressed in the title of the essay. This paper was submitted to the League of Illinois Municipalities last spring at the request of Mayor Warner of Peoria. In its 86 pages Mr. Foote discusses the franchise problem thoroughly and dispassionately. Premising that the question should be settled in the interest of all the people, and pointing out the disadvantages of purely municipal ownership on the one hand and unrestricted corporate ownership on the other, he suggests a system of municipal control by a board of municipal regulation to consist of three of the "ablest municipal officers in the employment of the people." To this board may be intrusted "all administrative questions pertaining to the construction of works, location of service lines, equipments, character of service, methods by which a service may be rendered and schedules governing its operation." Whether the service is rendered by the municipality or by corporations, this board is to be supreme, determining the questions of public policy involved for five-year periods. At the termination of any five-year period the municipality should have the option to continue to operate the industries or lease them, or, in case corporations are operating, the latter should be permitted to continue to operate them or transfer them to public ownership and operation, as deemed best by the board. In either case a system of uniform accounting, open to public inspection, should be adopted.

This is the merest outline of Mr. Foote's plan, and students of the question will naturally refer to the book for details which cannot be given here. The author thinks that his suggested system "holds the scales of justice in even balance. For both parties to the contract it is right and just."

The volume contains much general information of value to the seeker after knowledge of the municipal-franchise question, and a topical index makes it more available. One interesting statement is the estimate that there were in the United States in 1897 400 municipal electric-lighting plants.

Arc Lights on Church Steeple.

Some of the residents of the South Side, Chicago, have had their attention attracted of late by the illumination of the steeple of the Immanuel Baptist Church on Michigan avenue, near Twenty-third street. The pastor, Rev. Johnston Myers, conceived the idea of placing arc lamps at the top of the spire as a means of bringing his church into greater prominence. While workmen were repairing the steeple a short time ago, a large pulley and cable connections were placed within a short distance of the extreme pinnacle, and two lamps were hung at either arm of an iron-pipe T, the lower end of which was made secure at a window some 20 feet below. The wires pass up inside of the steeple, which is 225 feet high, and through the pipe to the lamps. To trim the lamps the wire is disconnected at the bottom of the T and the whole arrangement lowered by means of the cable passing over the pulley to the level of the window. The lamps are 500-watt, 100-hour, low-tension arcs, operated on a 115-volt circuit. Current is supplied by the Twenty-seventh street station of the Chicago Edison company. The church is also furnished with 450 incandescent lamps.

The electric-railway company intending to operate at Scottdale, Pa., has been reorganized with Hon. W. H. Graham of Pittsburg as president and George Sheppard of Pittsburg as secretary.

DEVELOPMENT OF THE TELEPHONE FIELD.

Development of the Independent Telephone Business.

By H. D. Critchfield.

Part II.

The independent telephone movement acquired its first great impetus in the middle western states. The greatest development has, up to this time, taken place in those states, notably Iowa, Wisconsin, Michigan, Missouri, Illinois, Indiana and Ohio, while Pennsylvania, Kentucky, West Virginia, Minnesota, Kansas, Nebraska and the Dakotas have followed but shortly in the rear. But within the past two years especially the movement has extended, until it embraces all sections of the country, and to-day from Portland to Atlanta, from Boston to San Francisco, from Minneapolis to Galveston, and all the intervening country, independent exchanges and toll lines are building, new money and new brains are becoming interested, new patrons are served, and new fields developed. This is not idle talk, as the following will illustrate: On the Pacific Coast Portland, Seattle and San Francisco are building; Minneapolis and St. Paul are building; New Orleans, Galveston and Austin are in different stages of completion. Memphis and Atlanta have recently organized strong companies which will prosecute the work to a successful finish at a very early day. I am informed that contracts for the Pittsburg switchboard and telephones have been let; Baltimore and Boston, the latter the home of the American Bell Telephone company, are building; that Philadelphia and New York will begin actual construction within the next 60 days. Cleveland will give service to more than 6,000 telephones before the close of the present year. More than 200 men are at work on the subway in Columbus, O., which will be in full service within eight months. Dayton and Springfield, Portsmouth and Marietta are at it; Indianapolis, St. Louis, Grand Rapids, Detroit, Dubuque, Sioux City, Cedar Rapids, Fort Wayne, Newark and Trenton, N. J., Worcester, Mass., and Richmond, Va., are among the larger towns and cities which are now giving cheaper and better telephone service through independent plants than has ever yet been given by the old company.

That the business has been safely and profitably conducted is proven by the fact that there have been fewer failures of independent telephone companies in the United States since they came into existence than there have been of national banks—a showing which no other business, with such phenomenal growth, has ever shown.

When we who are engaged in the business stop to think of this fact and realize the growth, but imperfectly indicated above, it must fill us with satisfaction and increase our courage for further efforts and still greater development. We have been convinced for many months—we can as yet scarcely talk about years—that we have no occasion to fear our opponents, although one of the strongest corporations in the country. All that the independent companies need do is to give good service, always aiming to build first-class plants, place your rates at a reasonable profit, but not so low as to deprive you from the income necessary to maintain your plant in first-class condition, and afford a reasonable return on the investment.

Such an array of facts must go far toward convincing the general public that their fears for the permanency and complete success of the independent movement are entirely groundless. They are certainly convincing to any reasonable person, for it must be remembered that this development has been in the face of every form of opposition that could be devised by a skilled and wealthy corporation, and it can hardlly be possible that more vigorous opposition will be encountered in the future than has already been met and universally overcome.

Some time ago, as some of you know, I attempted to discuss this general topic, more especially with reference to the year 1898, and after adverting to the impossibility of giving statistics, stated that I found great satisfaction in the fact that in the larger cities of the country independent telephone plants were approaching completion or soon to be built. To all of us this phase of development is most satisfying.

One thing, which I should have stated more clearly, is the fact that in almost every state in the Union, most notably, perhaps, in the Middle West, before referred to, strong combinations are being formed with the sole purpose of building first-class toll lines within their respective states and with an understanding or arrangement for the interchange of business with like companies in adjacent states. This work has already progressed, until many thousands of miles of this kind of construction are now built, connecting the local exchanges and toll-line systems with the outside world, and the work is rapidly progressing.

With this development must come, and through this association can and should come, a harmonious determination or solution as to the charges for service, not only local, but long-distance. In this field can such a body find a sphere for great usefulness, and were it the only department, would be ample reason for the existence of our organization. I am afraid that we do not always realize the fact that we are dependent to a great extent upon each other. We have been so busy trying to keep from being run over by our own business in our own localities—so uniformly successful, so almost overwhelmed with the growth in our own neighborhoods—that we have failed to look about us as we should, and fully appreciate the fact that to make our investment permanent and safe we must have the freest intercourse with our neighbors. Not only our immediate neighbors, but all those with whom our own communities do business, whenever that may be and wherever their business interests may require them to communicate. Let us pause a moment, both now and when we return to our constituents, and discuss this phase of the situation. Let us see if we cannot aid the wonderful development which is taking place, or rather direct it, so that the best results may accrue to all.

Another phase of the situation which has been briefly referred to is the character of construction. The growth toward better apparatus and better construction has been quite satisfactory, especially in the last two years. The time was when independent companies built carelessly, giving little attention to excellence in construction or superiority of apparatus. Other papers have given you valuable information in this department. I find from listening to the statements of those connected with the larger new companies and of those who have been longest in the independent field, as well as from personal observation, that very radical improvements have been made of late in the character of construction and results attained. Brains, inventive genius, have found a field among the independents, and the Patent Office has shown greater activity in this department of electrical inventions during the past four years than in all the preceding 20 years. Manufacturers are striving in every way to better the apparatus turned out by them. Operators are not slow to avail themselves of these improvements. Builders are using the best, and looking for better, the consequent result being that a service is now being furnished, especially by the more recently constructed properties, that has not heretofore been equaled by either the old or the new companies. But I must hasten.

In my own state a very important development has begun among the farmers. It is true that many of the small towns and villages are now successfully supporting telephone exchanges, and the farmers in the adjacent rural districts are getting service at a price within their means and are insisting upon telephone facilities. Thousands are already connected with exchanges, and tens of thousands more are applying for service in the more thickly settled agricultural regions of our country.

The telephone will soon be as proportionately general in the country as it now is in the towns, and, combined with the electric railway, will bring the satisfying conveniences of life to the homes of all, and will have no little influence in deterring many from leaving the farm to seek the comforts and conveniences of urban life, because they do not enjoy the isolation of the country.

I heard one of our members remark not long ago that, in his opinion, we were but at the threshold of the use of the telephone. That may seem an exaggeration, but when within two, three or four short years communities have increased their telephone service from two to 10 times, and there seems no cessation of the development, such statement cannot be considered inaccurate. This association, through its membership, through its influence upon state and smaller associations, through its organized committees, its bureaus of information, which certainly must be provided for in the near future, can and will exert a profound influence upon the further developments of the independent telephone business.

Heretofore the growth has been, one might say, sporadic; indeed, you could almost compare the exchanges scattered here and there to the appearance of a dry pavement, when, at the beginning of a thunderstorm, you see the great spatters of water as the big drops fall, and then, as they come faster and faster, the spatters run together, until the whole is covered. In the Middle West this process of running together is already well developed. In some other portions of the country the shower has just begun, but will spread and run together, until the whole country is as thoroughly developed as those sections in which the movement first originated.

It rests with us, and with others who will be attracted to the association because of its usefulness, actual and possible, to combine our efforts, while maintaining our individuality, and the benefit of local ownership and home control is to make of the independent telephone system a vast power for the benefit and advantage of the entire country. The telephone should be within reach of all, and the development which I have but hinted at in the foregoing will progress in geometric ratio, and when the future annual conventions of this association shall meet, while they will respect the attainments of the first five years of independent effort, it will be said that we were but digging the trenches and building the foundations for the then superstructure. Let us see to it that those foundations which we are now working on are ample in breadth and strength to support the whole future development, and that in after years we may say that we have planned wisely and executed well.

Independent Service in Jacksonville, Fla.

It is claimed that Jacksonville, Fla., has a larger proportion of telephones in private residences than any other city in the country. The independent company in that city is the Jacksonville Telephone company, which has been brought to its present state of efficiency by Mr. W. N. Shine, president and general manager. A recent visitor to Jacksonville had an interesting chat with Mr. Shine:

"After securing the names of nearly 700 of the best business people of the town as subscribers, Mr. Shine went before the City Council with an application for a franchise. When he had complied with every provision of the ordinance—and they were not easy—the franchise was granted. He put the rates at $30 a year for business houses and $20 for residences. The Southern Bell Telephone company, his rival, had been charging $60 and $48 for a service not altogether satisfactory. In April, 1896, he began the installation of the system. At the present writing the Jacksonville Telephone company has 705 telephones in use and is daily adding to the number of its subscribers. An inspection of the exchange showed that it is thoroughly up to date; that it has every appliance necessary to insure prompt and satisfactory service. Good authorities say Jacksonville has the best independent telephone system in the entire country, and from what I saw on my visit to the exchange I should judge it was true. The company will accept only responsible and reputable subscribers, and makes contracts for not less than one year or up to five years. I understand the old company makes monthly contracts and is not so careful as to whom it makes them with. The Jacksonville Telephone company has spent about $70,000 in installing its plant, but its bonded indebtedness is only $30,000. In the past 12 months it has spent more than $7,500 in extensions and improvements."

Independents' Good Prospects in Duluth.

Work was started on July 10th on the laying of the conduit for the new telephone system of the People's Telephone company of Duluth and Superior, Wis. Both Mayor Truelsen of Duluth and Mayor Diedrich of Superior were present and took part in the ceremonies, each of them making speeches to a large concourse of people that had gathered at Eighth street and Tower avenue, where work was started. Manager H. H. Stewart accompanied them. In his address the mayor of Duluth said:

"With a system on both sides of the bay the old company, which has been charging exorbitant prices and furnishing the poorest of service, will be forced to quit business and seek a location elsewhere. Its franchise in Duluth will expire in a short time, and then if it refuses to get out we shall chop down their poles and force them out. Then the people will see the necessity of patronizing the new company. There is not a business man in this city that can afford to be without connections with the people of Duluth, and the new company will soon be the only means at hand for them to reach the people across the bay. When the City Council of Duluth called for propositions for a new system of telephone the Bell people made none whatever, saying that it had rights which must be respected by the city. The company has furnished us with the most inadequate service imaginable, and need not be surprised that we accept the first opportunity to get something better."

False Report of Telephone Combination.

The Chicago Record of July 20th published a rumor that the deal for the combination of certain of the independent telephone manufacturing companies was closed in New York on the day before. The consolidation was to be known as the American Independent Telephone company, with a capital of $7,000,000, and was to be financed by Charles R. Flint & Co. of New York.

Diligent inquiry in Chicago, where some of the largest independent plants are located, failed to confirm the report. Representatives of the Stromberg-Carlson and Sterling companies denied with emphasis that their companies were in the combination. President P. C. Burns of the American Electric Telephone company, on his return to Chicago on Monday, said simply that there was "nothing new," and Mr. W. T. Blaine of the Victor Telephone Manufacturing company also said that the report was unfounded.

There seems to be little prospect that an effective telephone "trust" will be formed. The proposition has now been "in the air" for five months, and nothing has come of it. The options have mostly expired, and manufacturers are busily engaged in endeavoring to keep up with their orders, for their own benefit and not that of possible successors, without paying much attention to the disingenuous reports that are from time to time put into circulation.

Contracts have been let for the erection of a municipal electric-light plant at Palo Alto, Cal., at a cost of $14,000. It is expected to have the work completed by September 1st.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The new telephone exchange at Vinton, Ia., has begun operations, with 101 instruments connected. The Iowa Telephone company at once cut rates 30 per cent.

A. W. Chamberlain was granted a franchise for another telephone exchange in Webster City, Ia.

The Union Mutual Telephone company has been granted a franchise for a telephone exchange at Union, Ia.

Some of the aldermen of St. Paul object to paying a toll to connect with lines in the Midway district that are on the Minneapolis board. These subscribers have their choice which city they will connect with, and then calls from the other city have to pay toll the same as to any other part of the other city.

Manager Robinson of the new telephone exchange in St. James, Minn., has completed arrangements with the Northwestern Telephone Exchange company for toll-line connections.

Charles Jorgenson is erecting a new hotel in Albert Lea, Minn., and has let the contract for an exchange of 50 telephones to connect with every room in the building. Guests can sit in their rooms and connect with any line in the city or a toll line, if desired.

The Peerless Telephone company will construct a local exchange at Rio, Wis. The Poynette long-distance line will be extended from Poynette to Rio.

The Delavan Telephone company has been granted a franchise for an exchange at Delavan, Wis.

The Northwestern Telephone Exchange company has made a rate of 55 cents for one minute's talk from Minneapolis to Grand Forks, N. D. The company has recently extended its toll connections to Barnesville, Minn., and Langdon, N. D.

S. H. Schweizer of La Crosse, Wis., contemplates establishing a telephone exchange in West Salem, Wis.

The Sunset Telephone and Telegraph company has work well along constructing a line to Whidby Island, from Anacortes, Wash.

The Arcadia (Wis.) Telephone company has ordered materials for extending the lines to the town of Glencoe and Bill's Valley.

The State Board of Tax Review of Iowa finds it a very difficult matter to arrive at a fair value to place upon telephone lines for assessment purposes. The cost varies greatly, especially on toll lines. Some of the mutual and farmers' lines have been built at very little cost, while the city lines show a considerable cost.

The Litchfield Telephone company will build toll lines from Litchfield, Minn., to Strout, Greenleaf and Corvuso.

The four anti-Bell toll-line telephone companies entering Des Moines, Ia., are about to unite in the erection of a toll-line exchange. The work has been done through the Mutual Telephone company's board, but this company has found it a great deal of work and has asked to be relieved of it.

Thomas K. Surborrough of Omaha contemplates establishing a telephone exchange in Council Bluffs, Ia.

The Wausau Telephone company of Wausau, Wis., has recently installed a modern switchboard, having a capacity of 800, with an automatic ring-off and electric-light signals.

The Winona Telephone company of Winona, Minn., has ordered a 1,200-drop switchboard, 6,000 feet of cable wire and other materials for improvements, to cost about $7,000. The Northwestern Telephone Exchange company will erect a new exchange building in Winona, and will install a flash-light switchboard.

Mr. Nabel of Danewood, Minn., is arranging to put in a local telephone exchange at Mora, Minn.

The Northwood Telephone company has been formed to establish an exchange at Northwood, Ia.

The Fairmont Telephone company will build toll lines from Fairmont, Minn., to Madelia, and from Sherburn to St. James.

The Rocky Mountain Bell Telephone company proposes to erect a modern exchange building in Missoula, Mont.

The new switchboard for the Northwestern Telephone Exchange company's St. Paul office has arrived.

The Martin Telephone company of Webster City, Ia., has reached Radcliffe, Ia.

Bell People in Trouble at Ann Arbor.

The Michigan Bell company, at Ann Arbor, announces that it will not accept the ordinance passed in its behalf by the Common Council, in which the limitation of rates to be charged is annexed. A war on the corporation on part of angry aldermen is anticipated.

PERSONAL.

The duties of manager of the Citizens' Telephone company in Grand Rapids, Mich., until recently performed by Charles F. Boyce, will be divided between C. E. Tarte and A. A. Stacey.

It is announced that the Bell Telephone company will build a new business block at Battle Creek, Mich.

NEW COMPANIES.

The Lewiston (Mont.) Telephone company has been incorporated by F. E. Wright, A. W. Warr, T. J. Warr. The capital is $10,000. A telephone line will be constructed and maintained between Lewiston and Gilt Edge and Oka.

The Independent Telephone and Telegraph Construction company of Syracuse has been incorporated with a capital of $5,000. The directors are Ernest I. White, Edward Barneman, Syracuse, N. Y.; J. J. Jernigen and John L. Wentz, Scranton, Pa.

The Syracuse Telephone company has been organized in New York state, with a capital of $450,000; directors, J. J. Jermyn, Frank H. Jermyn, John L. Wentz of Scranton, Pa.; Edward Barneman, Ernest L. White, Manning C. Palmer, H. W. Plumb and Arthur R. Peck of Syracuse, George C. Wentz of Dsifton, Pa.

The Cottage Grove and Bohemia Telephone and Telegraph company has been incorporated to construct a telegraph and telephone line between Cottage Grove and Bohemia, Ore., and in other portions of the state. The capital is $5,000. I. H. Bingham, B. Lurch, D. Bristow, Frank Jordan and R. J. Jennings are the incorporators.

The new Citizens' Telephone company of Watertown, N. Y., has a capitalization of $50,000, and the general route is in and through the streets of Watertown and Jefferson County. The directors are S. C. Sherman, S. F. Bagg, Robert J. Buck of Watertown; Robert Bliss, Howard Gallup, Robert S. Monroe, James K. Whitaker of New York city.

The Niagara Falls Telephone company (capital stock, $100,000), has been incorporated. The points to be connected with the city of Niagara Falls are the towns of Lewiston and Porter and the villages of Lewiston, Youngstown and Lasalle. The directors are Samuel B. Rawson, Fred H. Sudro, James A. Dake, Irving H. Griswold of Elyria, O.; William R. Campbell, James E. Rock, Alan H. G. Hardwick and Walter A. Horne of Niagara Falls.

A charter was issued at Harrisburg, Pa., recently to the Home Telephone and Electric company of Pittsburg, having a capital stock of $100,000. The company proposes to erect telephone lines in Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties. It is also proposed to establish a number of exchanges in the city of Pittsburg and to furnish the suburban service of the Pittsburg and Allegheny Telephone company. It is stated that the company expects to be ready for business by the beginning of next year. The directors are Thomas B. Lee, Harry T. Van Ostrand, John S. Scully, Jr., John E. Black and John McD. Lee.

PACIFIC COAST NOTES.

The Oregon Telephone company is building a branch line from Astoria to Seaside.

Holmes Bros. are constructing a telephone line from Central Point, Ore., to Eagle Point.

The Sunset Telephone company's plant in Tucson, Ariz., is to be rebuilt for all-metallic circuits.

Steps have been taken to build an extension of the Ballast Point telephone line to the new light-house station at the extremity of Point Loma, Cal., and the government will be asked to aid in the project.

The Boise (Idaho) Statesman says that the Rocky Mountain Telephone company will expend $500,000 in extending new lines and improving the old ones. A double copper line will be extended from Idaho Falls to Dillon, a distance of 147 miles, and a similar one will be built from Weiser to Buffalo Hump, a distance of 140 miles.

The Inland Telephone and Telegraph company is making extensive improvements on its lines. A line will be built to connect Ritzville, Moscow and Edwards in Lincoln County. A line will be built from Arlington to Condon and Fossil, 70 miles in all, in Gilliam County, Ore. This line will be of aluminum wire, it is said.

It is said that the Sunset Telephone company will at once begin the erection of a long-distance line from Tucson, via Mammoth Mine, Florence, Pinal and Mesa City, to Phœnix, Ariz. From Phœnix the line may be extended north to Prescott and Jerome, and then to the line of the Santa Fe railroad, either at Ash Fork or Flagstaff. Ultimately the line will follow the railroad westward to California, connecting with California long-distance lines. Such a line as is proposed, including the best material, will cost from $400 to $700 a mile, making the total expense of the circuit from Tucson to the Santa Fe Pacific, $125,000.

The Muskegon (Mich.) Chronicle states that the Citizens' Telephone company of that city is putting in an exchange with 20 subscribers at Coopersville.

The construction of a new long-distance telephone line between Kankakee and Chicago has been commenced by the Central Union Telephone company. It may be extended as far south as Paxton. The improvement will cost $22,000. A rate of from 30 to 35 cents for a message of three minutes' duration between Chicago and Kankakee has been promised. The present rate is 56 cents for a five-minute talk.

TELEPHONE TALES.

Professor A (through the telephone)—"Didn't I leave my umbrella at your house yesterday?"

Professor B—"I don't know; here are two umbrellas. Is this one yours?"—Unsere Gesellschaft.

If you discover a "short-headed" bacillus on the telephone disk, don't drop it and run away, but simply brush the microbe aside and go on with the talking. However, if the microbe has a long head it would be well to call the physician and have the bug properly classified.—Des Moines Capital.

The joy of the all-night telephone girl, the one upon which her chief reliance is placed to help her cheat the long hours of weariness, is the sociable night clerks in the always-open drug stores. The latter entertain a sort of brotherly affection for the night operator, and evidently lose much sleep in inventing ways for her entertainment. The ways of the young drug clerk, fresh from college, are usually refreshing. As a general thing he can warble sweetly, and any knots that may be in his vocalization are toned down and smoothed out in transmission. His repertory is inexhaustive and includes everything in the song dealers' catalogue, and much that is not, from "Just One Girl" to "Cavalleria Rusticana." Then he tells such funny stories and is so unassuming. Besides, it is a poor drug store nowadays that doesn't boast a music box, and this is frequently brought into requisition for the benefit of the all-night operators. The poor, unostentatious dispenser of pills and physic is the telephone owl's idol.—Brooklyn Times.

"No, I am not engaged any more," said a newly arrived drummer to some friends at the Grunewald recently. "It was broken off by the long-distance 'phone, confound the thing! How did it happen, did y' ask? Why, it was like this: I was in Atlanta a few weeks ago and called up my fiancee in Macon to let her know when to expect me. The service costs 50 cents for three minutes, and I calculated I could deliver my message in about 14 seconds. But after I gave the dear girl the date she insisted, on holding me while she told about a lawn fête that some of the young people were getting up for the next day. I wriggled and writhed, and after she had imparted $2.50 worth of details I broke in and told her that somebody else wanted to use the 'phone. 'O no, they don't,' she replied, 'the operator here says you may have it as long as you wish,' and on flowed the legend of the lawn fête. She told me how all the girls were going to be dressed, what they had cooked for lunch, and how Annie Jones had refused to go with Billy Smith, because it was rumored that Billy played cards on Sunday. I groaned. I had been stuck for about $7, and time was flying at the rate of 16 2-3 cents a minute. 'What's the matter?' she asked, anxiously; 'you don't seem interested.' 'Yes, I am,' I said, with perfect truth: 'I am weighing every syllable.' 'Then repeat what I have been saying,' she ordered; 'go all over it and don't miss a word.' That was too much. I yelled: 'Ring off!' and banged the receiver on the hook. Next day I got a package from Macon, returning the engagement solitaire. There was a sarcastic little note in which she said she thought my suggestion about the ring was excellent and had acted upon it at once. Plague take long-distance 'phones! I never want to see one again in my life."—New Orleans Times-Democrat.

MANUFACTURERS AND DEALERS.

A matter of the greatest importance to telephone exchanges is the protection of their apparatus from burn-outs from lightning and other heavy currents. Numerous devices have been designed for this work. The one recommended by the Electric Appliance company of 92 and 94 West Van Buren Street, Chicago, is claimed to have a number of excellent points. The Electric Appliance company states that it has sold large quantities of these protectors and that the results have been most satisfactory.

The Eureka Electric company of Chicago has just succeeded in closing the contract for one of the largest, if not the largest, independent telephone exchanges to be installed this year—that at Houston, Texas. The Eureka apparatus was selected on account of its high quality and particular points of merit. In considering the different types of apparatus the engineers selecting the plant decided that the Eureka filled the specifications closer for high-grade telephone apparatus to compete against the Bell than any other presented. This speaks well for the Eureka company's apparatus, and especially as the company is one of the youngest in the business. No doubt it will be heard of in many large deals later on. At the present time the Eureka company has on hand orders calling for over 5,000 drops in switchboards of the Eureka metallic-express type, and in its telephone department it has about all the business it can handle. When it becomes a question of quality, the Eureka company promises that it will always be found at the front.

The Traverse City Northern Telephone exchange, operating at Traverse City, Mich., was sold on July 18th to Mr. W. W. Wheelock, for $10,000. Mr. Wheelock will proceed at once to put the exchange in first-class shape in every respect.

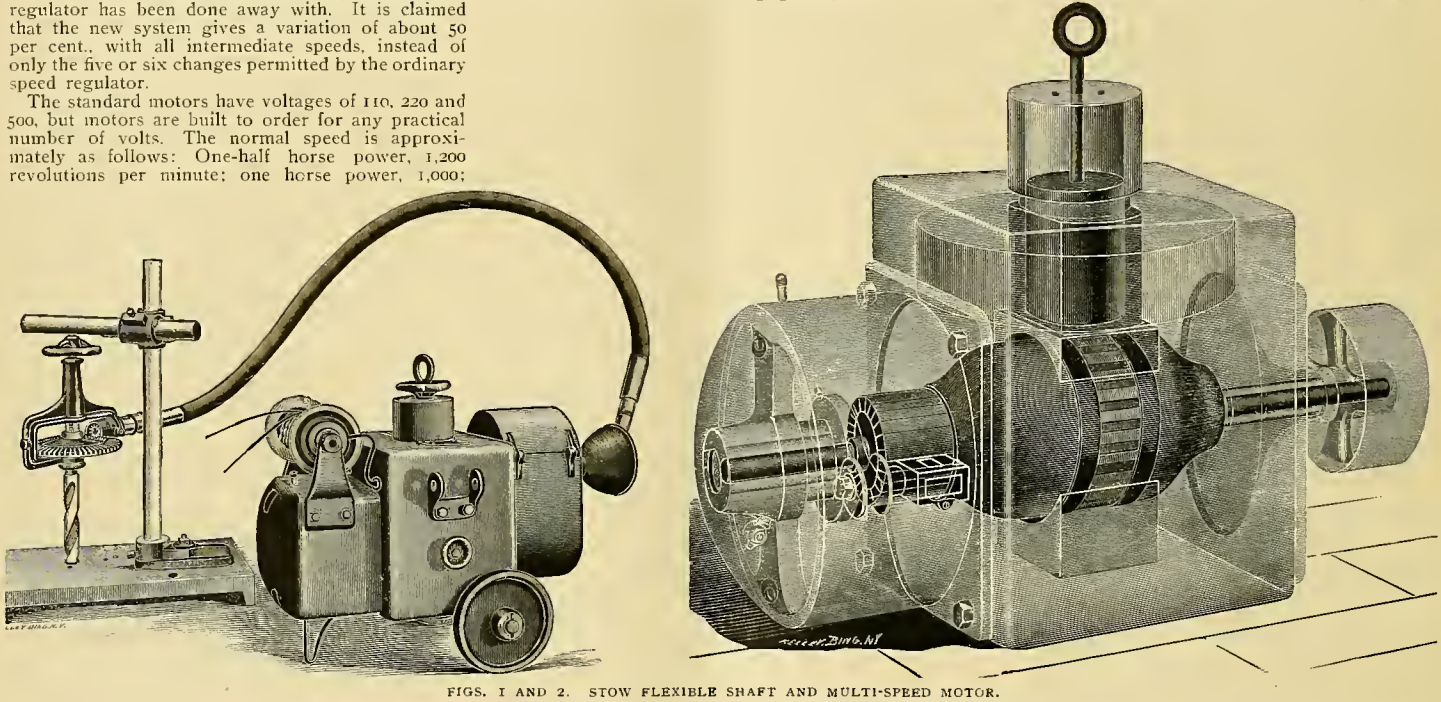
Stow Flexible Shaft and Multi-speed Motor.

The Stow Manufacturing company of Binghamton, N. Y., thinks that where a suitable current is obtainable the combination of its flexible shaft and multi-speed electric motor is the most practical and economical yet devised for a portable machine tool. Fig. 1 shows the motor and shaft combined to drive a drill, while Fig. 2 is a transparent cut prepared to show the method of speed regulation in the motor. A portable motor is, of necessity, subjected to much harder usage than a stationary one. It must be simple and durable in construction, practically dust and waterproof, and capable of being run at a great variety of speeds. The Stow iron-clad motor met these requirements to a large extent, but recent improvements in motor-speed regulation enable the company to offer now a portable plant which it believes to be above criticism. The economy of varying speed on a constant-potential current by varying the intensity of the field magnetism is, as compared with regulating the speed by armature resistance, undoubtedly conceded to be superior, but with methods formerly adopted greater air space and a heavier and more costly field structure were required, or a reduction of the motor horse-power rating—both objectionable in a portable motor.

For a motor of given horse power, the company says the cost has not been increased, the weight has been reduced and the old-time complicated speed regulator has been done away with. It is claimed that the new system gives a variation of about 50 per cent., with all intermediate speeds, instead of only the five or six changes permitted by the ordinary speed regulator.

The standard motors have voltages of 110, 220 and 500, but motors are built to order for any practical number of volts. The normal speed is approximately as follows: One-half horse power, 1,200 revolutions per minute; one horse power, 1,000; 1½ horse power, 900; two horse power, 750. These speeds can be increased by the new speed-rgulating device about 50 per cent. with all intermediate speeds, or a much lower speed than normal can be obtained hy the substitution of suitable gears.

Especial attention is directed to these points in the new motor: Simplicity; absence of rheostat; 50 per cent. variation in speed without loss of efficiency; accurate adjustment of speed between highest and lowest point; strength of the construction, which, with the simplicity, makes it unlikely that the apparatus will get out of order; peculiarly fitted for direct connection to tool machinery by its shape as well as the speed variation.



FIGS. 1 AND 2. STOW FLEXIBLE SHAFT AND MULTI-SPEED MOTOR.

Mount Whitney Power Plant.

The Mount Whitney Power company, operating one of the largest long-distance transmission systems in the West, has recently completed its plant. Power is derived from the Kaweah River, one of the mountain streams of Mount Whitney of the Sierra Nevadas. The water-wheels are directly connected to three Westinghouse three-phase generators, separately excited, each of 450 kilowatts capacity. There are four transformers of 500-kilowatt capacity each. Three of these are used at one time to raise the voltage from 440 to 20,000 or 34,000 volts. The power is distributed throughout the valley below to a distance of 43 miles. The towns reached are Exeter, Lindsay, Porterville, Viscalia and Tulare, where sub-stations are located for the final distribution of the electricity for irrigation, lighting and various power purposes. The following-named are the officers of the corporation: President, William H. Hammond; vice-president, A. G. Wishon; secretary, R. P. Hammond; assistant secretary, John Broder; consulting engineer, Robert McF. Doble; civil engineer, D. L. Wishon; electrician, Donald H. Fry.

The Nelson Electric Tramway company has been incorporated at Victoria, B. C., with a capital of $250,000, to build a tramway of 10 miles length in Nelson.

Removal of Wool from Skins by Electricity.

A process has recently been patented by a Bradford (England) syndicate for removing wool from skins by means of an electrical apparatus. This invention originated with a Bradford lady, Mrs. S. L. Johnson, and consists of an electric cautery or fleshing knife in such a form that the wool may be shorn or cut from the skin rapidly, and without injury either to the wool or to the pelt. The tool is held in the hand. Electric cables which pass through the handle are connected to the two terminals, and thence the current is passed through a wire of platinum-iridium alloy, which is thus rendered incandescent. The wire is fastened to and supported by a highly refractory substance, specially made for the purpose, the current required being about 60 amperes at a potential of four volts. The method of removing the wool is simply to push the cautery along the surface of the skin. The red-hot knife—if it may be so called—immediately mows down the wool, and the only limit to the speed at which the work can be done is the deftness of the operator. The work is performed so quickly that the heat in no way injures either the skin or the wool. It is estimated that a girl, with a few hours' practice, would be equal to dewooling from eight to a dozen skins per hour, and the cost of the current is so small—being estimated at the thirty-sixth of a penny an hour—as to be almost a negligible quantity. The advantages of this system of pulling will be obvious. The wool itself is not injured by lime, chemicals or other objectionable influence; the mere singeing of the end of each fiber is, indeed, imperceptible, and might, possibly, be even found to be advantageous rather than otherwise. The skin, which presumably has been sun-dried in Australia or South America immediately after the slaughtering of the sheep, is in itself in a more perfect condition for the tanner to deal with, and the cost of the process must work out at something very much less than any of the prevailing systems. It is estimated that, in any of the present methods, it costs the fellmonger four pence per skin to wet down, lime stove or sweat it into a condition for the puller, and the pulling wages range from 5½d. to 8½d. per dozen skins. The cost of the apparatus is small, and it is obvious, therefore, that this invention promises to effect such an economy that it will practically amount to a revolution in method. Some of the largest fellmongers and tanners in England, as well as many leading combers and others engaged in the trade at Bradford, have seen the invention at work, and, without exception, have signified their marked approval of the idea. The number of sheep annually slaughtered runs into many millions, and except during a very brief period of the year—about shearing time—these sheep are killed with the wool on the skin. How to get the wool off is a problem which has had many solutions. The most common processes in general use, perhaps, are the steeping of the skin and wool in lime water, and the sweating of the skins by steaming them, and piling them one upon another, thus inducing an incipient stage of decomposition. In both instances the wool is pulled from the skin by hand, and the process is most obviously an offensive one. Moreover, both wool and skin suffer to some slight extent in quality, and especially in the case of limed skins is wool deteriorated.

An extensive electric-railway system is building in Magdeburg, Germany. A correspondent says that it will cost in the neighborhood of $500,000.

A Year's Patent Record.

One of the surest indications of prosperity in this country is the number of patents issued. That the industrial health of the country is good is indicated by the figures of the Patent Office for the fiscal year just ended, from which it is learned that during that year there were received 35,352 applications for mechanical patents, 2,292 applications for designs, 91 applications for reissues and 1,861 applications for trademarks. There were 23,550 patents granted, including reissues and designs, and 1,406 trademarks were registered. The number of patents that expired was 16,670. The total receipts of the office were $1,209,554.88 and the total expenditures were $1,148,663.48, leaving a surplus of $60,891.40 to the credit of the Patent Office in the United States Treasury.

The most notable advance of the year in the work of the Patent Office has been the establishment of a classification division and its entry upon a thorough revision and extension of the classification of patents and printed publications, the examination of which lies at the foundation of the United States patent system. The necessity for this work, after being repeatedly called to the attention of Congress, was finally recognized, and an act was passed and went into force at the commencement of the fiscal year. It is already evident that the work of the classification division will prove of great benefit to the office, increasing the accuracy and rapidity of searches, and the public will experience corresponding benefits.

The work of classification involves the careful consideration of each patent in order to place it in its proper class and sub-class. Many of these patents have to be read to be fully understood, and much care must be taken to select titles which will clearly indicate the contents of each sub-class and to preserve clear lines between them. Cross-references are also necessary between sub-classes of the same class by reason of the presence of mixed matter in the same patent. A system of card index of sub-classes and other details has been perfected which will make it possible to detect and remedy any losses. Arrangements have also been made for the preservation of the classification and for the prevention of unauthorized changes by retaining under the supervision of the classification division all patents hereafter granted.

Playing Poker by Wire.

[From the Chicago Chronicle.]

Few outside the brotherhood of the key are aware that operators often play poker over the wire. It is, nevertheless, a fact, and the diversion is fairly common.

"When I was working on the Blankety-blank line at a little railroad station in Illinois," said an ex-operator the other day, "business was very slack toward early morning, and we used to get up a four-handed game regularly. The players were myself and three other operators at different points along the line. We would call each other up and then every man would deal himself a hand, making his discards and 'helping' as desired. Of course, we had to trust to mutual honor as to cheating, but I think everybody was on the square. All played freezeout, and the loser had to treat when we got together at headquarters, which was about once a month. I must confess that the action was a little slow, but the game was more exciting than one might imagine. Almost all the old operators have played cards by telegraph at some time or another."

Large Electric Barge.

About the time of the World's Fair and shortly thereafter electric-boat building in the United States received a decided impetus. For the last four years, however, the industry has shown no remarkable development in this country, and it has been left to English enterprise to produce the largest electrically propelled vessel—not a yacht, as might be imagined, but a plain barge, built as a freighter. In the ordinary steam barge, as the London Electrician points out, the space occupied by the boiler, engine and coal forms by far too large a proportion of the whole space available on board. The heat, moreover, resulting from such means of propulsion is often undesirable, and even dangerous to some forms of cargo. With a view to remedying these evils a large firm of manufacturers near Birkenhead has had its last new barge built for electric propulsion instead of for steam, and by so doing has for the same size of vessel increased the cargo-carrying capacity to nearly twice the amount.

The barge, which may probably be claimed to be the largest electrically propelled vessel in the world, is 75 feet long and 21 feet beam, with a total displacement of 225 tons when fully loaded. It carries 150 tons of cargo per journey. The battery consists of 112 Headland storage cells, with the Headland company's patent bar grid pasted in the ordinary way. Each consists of 29 plates, 9¼ inches high, by 12 inches broad, by one-half inch thick, separated by ebonite separators and placed in a lead-lined teak box 16 inches by 22 inches by 14 inches high. The box is sealed, but has a specially-designed fume outlet connected by lead piping to the outside air. The complete cell weighs 400 pounds and has a capacity of 2,000 ampere-hours at a normal discharge rate of 300 amperes. The whole battery is well insulated and is divided, part being in the bows and part in the stern of the vessel, the intermediate space between the two sections being occupied by cargo. In all, upward of 65,000 of the Headland bar grids were used in constructing this battery. The vessel is propelled by a twin-screw propellor worked by two 40 horse power motors, each taking a current of 150 amperes at a pressure of 200 volts. A Hopkinson series-parallel controller is used for varying the speed of the vessel. This is manipulated by the steersman, and has five notches from slow to full speed. A reversing switch permits the vessel to proceed ahead or astern at each speed, as desired. There is a winch or small crane on board, worked by an eight horse power electric motor, and taking 30 amperes at 200 volts. It has a separate controller with three speeds. The vessel is said to considerably outpace its sister steamboats of equal size, although it carries nearly twice the amount of cargo.

Bathers Killed by Lightning.

Earl Simpers, a well-known young athlete and swimmer at Chestertown, Md., was killed by lightning on the evening of July 9th, as he was about to dive. He had mounted a pile 12 feet high on a pier, and friends were watching him. As he stood poised for the plunge, says the New York Tribune, the flash came from a comparatively clear sky, and the young man fell to the wharf dead. A companion and a teamster and four horses that stood scarcely 20 feet away were shocked, but in no degree stunned. A number of workmen who saw the accident hurried to the spot, and as they raised the dead youth a second terrific shock came, stunning them all slightly The face, body and legs of the victim were discolored and his bathing suit was badly torn. The pile on which he stood was splintered and the wharf was damaged by the fatal current.

Miss Nellie Adams, only child of Mrs. Hamilton Seagreave Adams, with her friends, Miss Nina Miller of De Land and other guests of the Dewey House, went for a bath in the surf at Seabreeze, Fla., says the Baltimore Sun. They had scarcely reached the water when a sudden shower came on and a vivid flash of lightning, accompanied by a terrific burst of thunder, startled the party. Miss Nellie Adams fell, struck by lightning. Physicans were summoned, but life was gone when they arrived, and the indications were that death was instantaneous.

Fire in English Factory of the Western Electric Company.

The Western Electric company of this city has received a cablegram from London announcing a fire in its English works on July 21st. The loss was about $125,000 and was covered satisfactorily by insurance. The plant, until recently the Fowler-Waring Cable Works, is situated at Woolwich. Underground cables are manufactured almost exclusively, and as the works cover a good deal of ground it is probable that only a small portion was destroyed. This plant, together with the company's factories at Paris, Antwerp and Berlin, are under the management of Mr. F. R. Wells, who has his headquarters at Paris and who has been the company's European manager for 15 years. It is stated that Mr. Enos Barton, the president of the Western Electric company, who has been abroad, left the factory at Woolwich the day previous to the fire.

The 37-mile electric road building between Rochester and Sodus, N. Y., is nearing completion.

CORRESPONDENCE.

New York Notes.

New York, July 24.—Greater New York's street-car strike is dead, though not officially. The strike spread to this borough on Wednesday, but both in Brooklyn and Manhattan it came to an end practically on Saturday. During the week there was considerable disturbance and several futile attempts to stop traffic. On this side of the river the cars were delayed most on Second avenue, but the delay on that line was of comparatively short duration. An unsuccessful attempt was made early on Wednesday morning to wreck the elevated structure in Brooklyn at Fifth avenue and Thirty-sixth street, by means of dynamite. Several of the strikers were arrested, but they were afterward discharged for lack of evidence. Grand Master Workman Parsons asserted that 1,500 men had quit work on the Metropolitan lines, but the company claimed that the number did not exceed 400. The vacancies were promptly filled, anyway, and more men applied than were needed. The Brooklyn Rapid Transit company was very liberal with its men who were loyal to the company and refused to strike. They were paid double wages, were furnished with meal tickets, and received additional compensation for sleeping in the barns during the nights when the greatest trouble was feared.

A libel suit was a direct outgrowth of the strike. Clinton L. Rossiter, president of the Brooklyn Rapid Transit company, was arrested on Friday on a charge of libel preferred by Albert Johnson, who, with his brother, Tom L. Johnson, formerly controlled the Nassau railroad. The complainant alleged that he and his friends were practically accused by Mr. Rossiter of having been responsible for the dynamite outrage at Fifth avenue and Thirty-sixth street on Wednesday morning. John Weldon, a reporter, in a sworn statement, substantiated the declaration of Mr. Johnson. Mr. Rossiter, through his counsel, pleaded not guilty, and a hearing of the case was set for next Thursday morning. He was paroled in the custody of his lawyer.

At a special meeting on Wednesday of the stockholders of the Third Avenue Railroad company it was decided to increase the capital stock of the company from $12,000,000, the present amount, to $40,000,000. The new stock will be issued for the purpose of paying off the company's floating debt, incurred in the acquisition of the securities of other street railways and for changing the motive power of the Third avenue line and the acquired lines. Fifteen million dollars of the $28,000,000 new stock, it is estimated, will be needed to pay for the improvements on the various lines of the Third avenue system. The stockholders of the Forty-second-Street, Manhattanville and St. Nicholas Avenue Railway company, which is controlled by the Third Avenue Railroad company, met on the same day and voted to increase the capital stock of their company from $2,500,000 to $7,500,000, the proceeds of the new issue to be devoted mainly to defraying the expense of equipping the road with elecetricity.

M. S.

Northwestern Notations.

Minneapolis, July 22.—Keystone, Benton County, Ia., is said to be the smallest city in the state to be lighted by electricity. Otto Kroymann is installing the plant.

W. I. Gray of Minneapolis has made a survey and will make estimates on the cost of the proposed electric line in Mankato, Minn. He places it roughly at $450,000, including nine miles in the city and a line to Alma City, Minn.

Will J. Browne has assumed charge of the Light and Traction company's system at Dubuque, Ia. Improvements will be made to the line.

The sale of the Edison Electric company's plant in Appleton, Wis., to the Fox River Valley Electric Railway company is about completed. The new owner will make extensive improvements.

The Coon Rapids Power company has been incorporated in Minneapolis, to dam the Mississippi River, above Minneapolis, and develop electric power. The officers are those of the Twin City Rapid Transit company and the capital stock is $200,000.

The Burgess Electric company of Duluth, Minn., has been awarded the contract for an electric-light plant for the University of North Dakota, at a cost of $4,000.

The Oshkosh and Stevens Point Electric Railway company has been incorporated to build a line between those cities in Wisconsin. It will cut off 70 miles of travel between Ashland and Chicago. The capital stock is $150,000.

It is reported at Sioux City, Ia., that the Standard Oil crowd, so called, is after the street-railway systems of Kansas City, Omaha, Sioux City, Minneapolis and St. Paul. An expert is undefstood to have been examining the systems, one after the other.

The city of Larimore, N. D., has voted to put in an electric-light plant.

The officials of Duluth, Minn., contemplate calling an election to vote on constructing an electric-light plant.

John D. Cuddihy of Red Jacket, Mich., and others have abandoned the projected electric-car line which was to connect the village of Calumet, Mich., with suburbs. The Calumet and Hecla company controls the streets and everything else there, and the route which it would allow cars to run on would suit the needs of the company, but would not serve the bulk of the population.

Edward B. Beebe, night manager of the North American Telegraph office in Duluth, Minn., died recently of cancer of the liver.

The La Crosse (Wis.) City Railway company has adopted an amendment to its articles of incorporation, allowing the company to furnish electric heat, light and power from the trolley wires. The officers claim the company does not intend to go into the business except in a small way and as an accommodation. The La Crosse Edison Light and Power company threatens to apply for a street-car franchise and put in a system, if its field is invaded.

Chief Engineer Boyd Champlain of the Fargo (N. D.) Electric Light company lost his left arm recently, by getting it caught in an armature.

The Minneapolis (Minn.) Electric Light and Power company has applied to the court for an order of dissolution. The company has done no business for five years.

The Municipal Construction company of Chicago has made a proposition to the city of Council Bluffs, Ia., either to buy the present electric-light system or build a new one and turn it over to the city. The municipality is to operate it on its own responsibility, pay interest on the investment, and pay annually to the company a sum equal to the present price of its electric street lighting, to be applied on the principal until the entire cost is liquidated. The estimated cost is $50,000 to $60,000. The city is now paying $11,000 per annum for light.

The Interstate Traction company of Duluth, Minn., has filed a trust deed of $50,000, running to the St. Paul Title and Trust company, to secure the issuance of that amount of bonds. But $20,000 will be issued at present, and the remainder kept for future extensions.

The plant of the People's Light company of Moline, Ill., is being practically doubled. The power station is being enlarged and a number of new machines for the production of current put in. A steam-power plant of 1,500 horse power has been added.

Lightning struck the power house of the Oelwein Electric Light and Power company at Oelwein, Ia., recently, and burned out a few coils in the dynamo, then running into the ground. All the machinery stopped instantly, but it was soon started again. The lightning arresters were defective.

E. R. Thatcher, head miller of the Sheffield Milling company of Faribault, Minn., has constructed an electric oven, to be used in testing flour. The heat is furnished by means of copper wires coiled around thin pieces of slate, both top and bottom.

The Perry Electric Light and Power company of Perry, Ia., has amended its articles, increased its capital stock $10,000, making it $30,000, and adding heating to its business.

The D. & D. Electric Manufacturing company of Minneapolis secured the contract to furnish an electric-light plant for the village of Two Harbors, Minn., at $8,000.

The Kaukauna (Wis.) Electric Light company has passed into entirely new hands. Thomas Earles has been installed as president, succeeding his brother, Dr. William Earles of Milwaukee, who has been president since the organization of the company.

The Ottumwa (Ia.) Gas, Light, Heat and Power company has amended its articles, making the capital stock $200,000.

Fairbanks, Morse & Co. of St. Paul secured the contract for an electric-light and water plant at Belgrade, Minn., for $7,500.

Melrose, Wis., will be asked to vote $9,500 bonds to aid the projected electric line between La Crosse, Wis., and Neillsville. If this is successful, other towns along the line will be invited to vote similar aid.

C. W. Warfield of Duluth, Minn., will install an electric-light plant in Bemidji, Minn., at once.

C. T. Busha and E. O. Clark have been granted a 30-year electric-light franchise at Big Timber, Mont., and have ordered machinery.

The employes of the Chippewa Valley Electric company at Chippewa Falls, Wis., have a grievance which they want redressed. They ask for either a reduction in hours or an increase in wages; seats on the interurban line outside the city, pay during stops for repairs and allowance for expenses while delayed at Chippewa Falls.

The Commercial Light and Power company of Duluth, Minn., says that $100 per annum per arc street light now is as cheap as $85 for the same service was a year ago, on account of the increased cost of everything.

The village of Waterloo, Wis., will soon be lighted by electricity. The Village Board decided to put in a plant recently.

S. A. Bowe has been granted a franchise for an electric-light plant at Huron, S. D. He will repair the present plant and improve it.

The electric line from Waupaca, Wis., to the Chain o' Lakes is completed and in operation.

The State Electrical Board of Minnesota held its first formal meeting recently and selected a seal, agreed upon the form of license to be issued and appointed a committee to draft a constitution.

It is proposed in St. Paul to purchase material and install a police-alarm system in connection with the

fire-alarm system, using as much of the old material of the present system as possible.

It is reported an electric line to run on the east shore of Lake Winnebago, from Fond du Lac, Wis., north, is projected. It is understood that the Fond du Lac Electric company is interested in the scheme.

The city of Superior, Wis., will put in a new system of fire alarms, using storage batteries instead of gravity cells.

It has been reported that the General Electric company was in the market to purchase the street-railway system of Des Moines. President Polk denies that there is any likelihood of the system being sold.

The contract has been let for the erection of a power house for the village of Hibbing, Minn.

A. A. Abbott of Butte, Mont., and others propose to establish an electric-light plant at the head of Rock Creek, Mont., near Anaconda. J.

Canadian Intelligence.

Ottawa, July 22.—The annual report upon municipal statistics of the province of Ontario contains an interesting feature, which goes to show the development that has taken place in electric-light plants in the province. The figures are complete only to the end of 1896, and since then there has been considerable augmentation, but at the end of that year the electric-light plants, in towns only, aggregated in value $389,280, and in villages $9,950.

At the annual meeting of the Royal Society of Canada at Ottawa, Mr. T. C. Keefer, C. E., president of the society, read a highly instructive paper on "Canadian Water Power and Its Electrical Product." Mr. Keefer showed the vast resources possessed by the Dominion, especially in its central and and western portions. Many of the Canadian rivers differ largely from those in the South, by not being navigable at certain parts, owing to falls and cataracts, in all of which was stored up immense resources of latent energy, and which only needed harnessing to be utilized.

The project of the Ottawa Suburban Railway company to construct a system of electric radial railways, centering in the Canadian capital, has been kept very quiet. Nothing very definite has been heard of the scheme until it was presented before the railway committee of the Dominion House of Commons. The company, which is said to be abundantly responsible financially, proposes to build about 50 or more miles of electric road in the vicinity of Ottawa.

The Secret Service Bureau of Montreal, Que., has had entrusted to it a case which, it is promised, will create a stir when the matter is given publicity. It appears that a systematic theft of electric power has been carried on by a number of firms in Montreal which use electricity for motive purposes. The method for purloining the current from the wires without any record being shown by the meter is very ingenious, and an entirely novel one. Its detection will necessitate steps on the part of electric companies to overcome the facility with which the scheme can now be operated.

It is said that the two largest electrical power companies of Ottawa, Ont., the Metropolitan Electrical company and the Deschenes Electrical company, are about to amalgamate and will practically control all the most valuable and available water power in the immediate vicinity of Ottawa. The chief reason for the deal is said to be the anxiety of the Metropolitan company to start at once to sell light and power in Ottawa. While the 5,000 horse power which the company is now developing within a few miles of Ottawa will be available before snow flies, it is considered to be a great advantage to get an immediate start from the use of power already developed by the other company. The latter company having no franchise to operate in Ottawa, its surplus power, as it now stands, is of no use. The Metropolitan company, it would appear, is profiting by the experience of the Cataract Power company of Hamilton, Ont., which has bought up all the power in sight in that vicinity, and, in addition, has purchased the Hamilton street railway and all the radial roads running into that city. The Cataract company developed 5,000 horse power 40 miles from Hamilton, at an enormous expense, and transmits it by copper cables. A New York syndicate was behind the company, furnishing the capital for the purchase of the street railway and the radial roads, and so successful has been the venture that nothing less than $500 will buy a share in the company at the present time. The Metropolitan company claims that it has a more valuable property than the Cataract company, as it is developing the power at comparatively small cost and within four or five miles of the city. The machinery and plant will be of the most modern design and the facilities the very best. As there will be a number of suburban electric railways projected around Ottawa in the near future, the Metropolitan company will find a ready market for a large proportion of the power it intends to develop.

The Montreal Street Railway company's arrangements for insuring its employes have been announced to the staff. The schedule of compensation for injuries, either on or off duty, is as follows: Death from accidental injuries, $1,000; loss of both eyes, both hands or both feet, $1,000; one hand and one foot, or one hand or foot and one eye, $1,000; one hand, one foot or one eye, $500. If an accident is met with which does not result in the loss of any of the members mentioned, but which incapacitates from working, the sum of $5 a week, for a period not exceeding 26 consecutive weeks, will be paid. If an employe become afflicted with any of the following-named diseases, similar compensation will be given: Typhoid, typhus, scarlet fever, smallpox, pneumonia, appendicitis, diphtheria.

A 75-kilowatt S. K. C. dynamo was put in operation at Grand Valley, Ont., a short time ago, and is now supplying from one phase of the machine the town of Grand Valley with 500 incandescent house lights and some 50 candle power street lamps. From the other phase of the same machine, which is wound for 5,000-volt current, the owners are supplying the town of Arthur, 12 miles away, with about 600 incandescent house lights and five enclosed arc lamps, as well as 15 32 candle power incandescent street lamps. This plant is one of the most unique and complete in Canada.

The power house and factory of the Bronson & Weston Carbide Works, at the Chaudiere here, are being rapidly pushed forward to completion. The factory will be built entirely of stone and steel, and will be five stories high. The contracts have been let for the electrical machinery and water-wheels, which, including the carbide plant, will cost over $225,000. The generating plant will consist of two 3,000 horse power, single-phase generators, directly connected to horizontal turbines. There will also be two 400 horse power, 225-volt, direct-current machines for operating motors for crushing, mixing, etc. The switchboards will be of gray marble, containing all the necessary instruments for controlling the heavy currents incidental to the operation of such large generating units. The current will be conveyed from the large alternating generators at a potential of 2,300 volts to the transformer house and carbide works, where it will be transformed down to 75 volts for the furnaces. The 225-volt current will also be taken direct from the generators to the various buildings for the supply of power. The entire plant, it is expected, will be in operation by the first of the year, and the works will be run day and night.

The new plant built by the Royal Electric company of Montreal, Que., for the Chambly Manufacturing company, has been turned over to the latter company, and water power is now used instead of steam to run the new system, which is now supplying power in that city. The work was commenced in 1896, and every portion of the apparatus was manufactured by the Royal company. The power is transmitted to Montreal by wire, the actual length from the power house to the city being 17 miles. The plant consists of four generators of the S. K. C. alternating-current type, each with a capacity of 2,650 horse power, and the largest of their kind. The generators in use at Niagara are of 5,000 horse power each, but they are not so large as those at Chambly, but they are run at a higher speed. The electric current is conducted by cables in conduits below the floor of the building to the cable gallery or tunnel, and from there to the switchboard, on which are mounted switches of special design, which are the largest in the world, and capable of connecting or disconnecting a larger amount of energy than has hitherto been undertaken. This is possible, as each switch is capable of connecting or disconnecting each generator from the lines up to a capacity of over 3,000 horse power. The power-house building is some 320 feet long and the switchboard at present in place 120 feet long. Provision has been made for four more generators, giving an ultimate capacity for the power house of 20,000 horse power.

Reports just received at the Public Works Department, at Ottawa, give details as to the progress of the Canadian government's Yukon telegraph line. In May last the wire had been strung a distance of 54 miles, and now the report states that the line is completed to Lake Lebarge, which is 15 miles beyond White Horse Rapids, and 128 miles further on than Bennett, which is already connected with Skagway by a telegraph line belonging to the White Pass Railway company. It is expected that the government line will be into Dawson City by the 15th of October next. W.

PERSONAL.

Mr. H. B. Kinney, a well-known electrical man in Omaha, Neb., was a visitor in Chicago last week.

Mr. C. W. N. Money of the Commercial Electrical Supply company of St. Louis was in Chicago on Monday. He says that business throughout the Southwest is excellent.

The London Electrician is "authoritatively informed" that on his return to Glasgow from his stay in London Lord Kelvin will tender his resignation of the professorship of natural philosophy at Glasgow University.

R. B. Williamson, E. E., has been lately appointed principal of the School of Electricity of the International Correspondence Schools of Scranton, Pa. H. S. Webb, formerly of Lehigh University, is the new professor of telegraphy and telephony, succeeding Mr. Kempster B. Miller in that position.

Charles F. Perry, superintendent of contracts for the Edison Electric Illuminating company of Brooklyn, fell dead on July 18th at his home, 190 Schermerhorn street, Brooklyn. He was on his vacation and had made arrangements to start for the country with his family. He was 48 years old and one of the leading members of the Masonic order in Brooklyn. A wife and two sons survive him.

Many friends will be pleased to know that Mr. Henry L. Doherty, long general manager of the Madison (Wis.) Gas and Electric company, has recently been elected to the presidency of this company. A new board of directors of the Madison company was elected recently, and Mr. Emerson McMillin resigned from the board as president, and Mr. Doherty was elected to fill his place. The appointment indicates the confidence in which Mr. Doherty is held by capitalists in control of gas and electric properties. Mr. Doherty's capabilities are highly esteemed in the West, as his election to the presidency of the Northwestern Electrical association showed, and this new evidence of confidence on the part of his associates is gratifying rather than surprising. Mr. Doherty as general manager of the Madison company has been very successful.

ELECTRIC LIGHTING.

J. B. Kurtz of Portland has been granted a franchise to furnish electric light and water to Woodburn, Ore.

The Commonwealth Electric company of Chicago is building a large addition to its station at Wallace and Fifty-sixth street on the South Side. Two direct-connected generating units will comprise the initial installation, one of 1,000 kilowatts' capacity and the other of 400 kilowatts. The new plant will consist of Babcock & Wilcox boilers, Southwark engines and General Electric three-phase alternators.

The commissioner of Indian affairs is inviting sealed proposals, until August 7th, for furnishing and delivering the necessary materials and labor required in the construction and completion at the boarding school, Warm Springs Agency, Oregon, of an electric-light plant. Plans, specifications and instructions to bidders may be examined at the United States Indian warehouse, 235 Johnson street, Chicago, Ill., the Indian Bureau at Washington or at the agency.

ELECTRIC RAILWAYS.

Fire destroyed the car stables of the Boston Elevated Railway company on River street, at Cambridge, Mass., on July 21st.

Mr. E. A. Tennis of Milton, Pa., the promoter of the Lewisburg, Milton and Watsontown Passenger Railway company and the president of the corporation, has purchased the interest of the other stockholders in the line and is now the sole owner of the stock of the property. Mr. Tennis has in contemplation the extension of the line to Montoursville.

At a recent meeting of the council of Gloucester, N. J., an ordinance passed first reading giving to the Delaware River and Atlantic City Railroad company—said to have been recently incorporated with a capital of $6,000,000—a franchise to lay tracks from the Gloucester ferry through the city. It is stated that the object of the company is to build an electric road 52 miles in length to Atlantic City, using the three-rail system.

AUTOMOBILES.

The United States Express company will experiment with electric wagons in New York, as it has done in Chicago. A trial vehicle will be furnished by the Fischer Equipment company of this city and if it proves adaptable a large number will be built.

The C. H. Sieg Manufacturing company of Kenosha, Wis., will be reorganized, and instead of making bicycles will manufacture automobiles and gasoline engines. Owing to the changes and fluctuations in the bicycle trade, the company has decided that there is more money in automobiles. The present building will be enlarged and more men employed.

A Washington dispatch says that Postoffice Department officials expect to ask for an appropriation at the next session of Congress for the use of automobiles in collecting the mails at all first-class postoffices. The purpose is to ask permission to use the appropriation of $410,000 made for horse hire. The recent tests in Buffalo have satisfied the officials that automobiles may be used to advantage.

Professor Elihu Thomson has had constructed at his laboratory in Lynn, Mass., a new form of automobile. It is propelled by steam generated by a kerosene engine, and Professor Thomson suggests, half in earnest, that it bear the name "steamomobile." The vehicle operates successfully and is capable of attaining a speed of 36 miles an hour. Sufficient fuel, which is common kerosene, can be carried for a 60-mile run, although water must be taken on every 40 miles.

The Howard H. Brown Automobile company (capital stock, $100,000) was incorporated in Springfield, Ill., July 22d. The incorporators are Howard H. Brown, Dr. P. B. Hayes, Harold A. Smith and A. L. Kull, all of Chicago. This company has acquired by purchase the first-mortgage bonds of the Elgin Sewing Machine and Cycle company at Elgin.

The plant is said to be fully equipped with machinery necessary for the manufacture of automobiles. The company expects to get possession of the Elgin plant in a few days and will then commence building automobiles.

ELECTRICAL SECURITIES.

The directors of the General Electric company, Boston, have declared a semi-annual dividend of $3.50 a share on the preferred stock, payable July 31st to stockholders on record July 15th.

The Yuba Electric Power company, by its president, John Martin, has executed a deed of trust of all its property, water ditches, water rights, electric-light plant and other property to the Mercantile Trust company of San Francisco, as security for $1,000,000, which sum the power company was authorized, by its directors, to create as a bonded indebtedness. The bonds, which are dated June 1, 1899, bear interest at the rate of six per cent. per annum, payable semi-annually.

TECHNICAL SCHOOLS.

The catalogue of the University of Wisconsin for 1898-99 forms a volume of 360 pages. Full information about all the departments, including the College of Mechanics and Engineering, is given.

The annual catalogue of the University of Arkansas gives the calendar for 1899-1900 and the announcements for its different courses for the ensuing year. The work in electrical engineering is given under the supervision of Professor William N. Gladson.

The third annual register of the Lewis Institute of Chicago gives detailed descriptions of the courses and the methods of instruction in the school and a general announcement for 1899-1900. The Institute consists of the School of Science and Literature and the School of Engineering. The latter offers a four years' course in mechanical and electrical engineering.

PUBLICATIONS.

The Electric Storage Battery company of Philadelphia issues a circular descriptive of the installation of chloride accumulators in the factory building of Jones Brothers, Brooklyn, N. Y.

"Brazing by Immersion" is the title of a pamphlet recently issued by the Joseph Dixon Crucible company of Jersey City. It is a reprint from the Cycle Age and gives a good description of the process of brazing, as applied to bicycle manufacturing, using the Dixon company's crucibles.

The August issue of Cassier's Magazine is an "electric-railway number," containing articles by F. S. Pearson, Robert W. Blackwell, Thorburn Reid, Cary T. Hutchinson, A. V. Abbott, the late M. K. Bowen, Louis Bell, Frank J. Sprague, D. C. Jackson, William J. Clarke and others

The International Correspondence Schools of Scranton, Pa., issue interesting pamphlets giving pertinent information regarding their courses of instruction. The advantages of the correspondence system, the methods of instuction and outlines of the courses are features of the pamphlet on electrical engineering.

"Resistance Wires" is the subject of a neat booklet issued by Wilbur B. Driver & Co., 126 Liberty street, New York. The claims and advantages of Climax, Advance and "D" resistance wires are strongly set forth. Tables showing the properties and carrying capacities of the different wires furnish valuable data.

The Blakely Printing company of Chicago issues a handsome and tasteful souvenir booklet to announce its removal to 126-132 Market street, where it has one of the largest plants in the country for the printing of books and periodicals. One of the most notable achievements of the Blakely company was the printing of "The Book of Wealth," each volume of which sold for $2,500.

A new 16-page weekly, The Other Side, has appeared in Chicago. It is devoted to the discussion of the timely questions growing out of the relations of public-service corporations to governments and municipalities. Its special mission seems to be to take care that the side of the companies, "the other side," gets a fair show and a fair hearing. It is published by the Other Side Publishing company, 126-132 Market street, Chicago.

The Chicago Tribune is publishing a series of articles entitled "The Nineteenth Century Passed in Review." The second installment appeared last Sunday in the shape of a 12-column article on electricity and its development. As the industrial application of electricity is an attribute of this century entirely, this review of electrical progress is really a condensed history of the art. It is carefully written and valuable for reference.

The report of Mr. Willis L. Moore, the chief of the Weather Bureau of the United States government, for the year ended June 30, 1898, has been issued by the Government Printing Office. It contains a mass of valuable and interesting information relating to the work of the bureau, including detailed statistics of the climatology of the United States and a section devoted to the climate of Cuba. In the section devoted to new work Mr. Moore briefly describes the observations of wind velocity, temperature, barometric pressure and humidity made by the aid of meteorographs—invented by Professor Marvin—carried to high altitudes on specially constructed kites. In discussing the kite ascensions Mr. Moore makes the interesting observation that "Notwithstanding numerous small and a few serious accidents to the kite itself, the meteorographs have thus far completely escaped injury, often in a seemingly remarkable manner. In one case, with 12,000 feet of wire out, the kite was struck by lightning, fusing the wire and setting the kite adrift. Both the kite and the meteorograph were discovered the second day afterward 20 miles away. The kite was but little injured and the clock of the meteorograph was still running. In another case the kite broke away at great elevation and soon disappeared from sight. The most careful search failed to discover a trace of its whereabouts, and it was given up as lost, either in the waters of adjacent lakes or the somewhat more distant Canadian forest. About three weeks later the meteorograph was found and returned to the Weather Bureau, having suffered only such injury as resulted from the long exposure to the weather."

MISCELLANEOUS.

The strike of the electrical workers of Washington, which has been in progress for the past few weeks, has ended in a compromise, providing for an eight-hour day and time and a half for overtime.

The People's Subway company of Syracuse, N. Y., has been incorporated, with a capital of $10,000, to construct underground electric subways and conduits. The directors are J. Jermyn of Scranton and Edward Barnenan of Syracuse.

The Sperry Flour company of Stockton, Cal., has received a very large motor which will be used to supplant the steam power now used in its mill. The power will be furnished by the Blue Lakes plant, 43 miles distant. The motor was built by the Westinghouse Electric and Manufacturing company of Pittsburg. It is designed for operation at 2,200 volts, and is rated at 450 horse power.

A fire and police review will be a feature of the coming convention of the National Association of Municipal Electricians in Wilmington on September 6th. President Aydon reports that he has sent out the final invitations for the convention, and that the replies he has received point to a large attendance. Pyle's Cycle Academy, which has been secured for the electrical exhibits, has been blocked off and the spaces on the floor sold to various electrical companies. The spaces are all taken, and there will be an electrical show, lasting from September 4th to September 9th, that is expected to be very instructive and attractive.

TRADE NEWS.

The daily newspapers assert that the National Electrical Manufacturing company of Milford, Conn., has been awarded a contract for installing a fire-alarm system in Windsor Castle for Queen Victoria.

The Falcon Electric Manufacturing company of New York has been incorporated with a capital of $50,000. The directors are Edward Leissner and H. O. Swoboda of New York and L. E. Frorup of Brooklyn.

The Holmes Fiber-graphite company, desiring to increase its facilities, has secured a commodious factory building at 5155 Wakefield street, Germantown, Philadelphia, where all communications should now be addressed.

President Gerald W. Hart of the Hart Manufacturing company of Hartford, Conn., was in New York last week. Mr. Hart's new "Diamond H" switch has met with such demand that his factory is taxed to the limit.

The business of the Columbia Incandescent Lamp company of St. Louis throughout the Northwest has been increasing to such an extent that the company has opened a branch office at 295 Syndicate arcade, Minneapolis, with Mr. Guy V. Williams in charge.

C. E. Woods, general manager of the Fischer Equipment company, Chicago, was a visitor in New York last week. Mr. Woods is extremely busy, as his company has been almost overwhelmed with orders. But his large automobile factory in Chicago possesses ample facilities with which to meet the demand.

Mr. W. N. Matthews of St. Louis, the energetic dispenser of electrical bargains, is astonishing his friends with letters typewritten partly in red and partly in black. The scheme originated with Mr. Matthews, and the red words stand out clearly among the black, and emphasize important statements in a very striking manner.

First economy is often poor economy, but it required several years to prove it electrically. Reliable goods always succeed in the end. Bullock apparatus is made of material selected through years of experience, assembled with the most accurate machinery and sold under a responsible guaranty. The Central Electric company, Chicago, is the western agent.

The combined maximum and integrating electric meter recently placed on the market by its inventor, Edward S. Halsey of Chicago, is an instrument of considerable merit. The invention consists of a novel and simple device, which may be attached to integrating supply meters of standard make, now in common use, thus giving to them the additional function of a reliable maximum recorder.

Inventors or exploiters of novel electrical devices who may be interested in exhibiting such mechanisms at the Paris Exposition may find it worth their while to correspond with Mr. Gaston Lagelouze, at 11 East Twenty-second street, New York city. Mr. Lagelouze is United States representative for a prominent Parisian organization that controls valuable space at the Paris Exposition, and is in search of some new and interesting invention that would prove attractive. The space referred to is said to be worth 500 francs a square meter (about $10 a square foot), and Mr. Lagelouze states that it may be offered free, under a special agreement with the inventor relative to exhibition at the fair and the agency in France, provided, of course, the invention is of a sufficiently novel, valuable and interesting character.

BUSINESS.

The Central Electric company, Chicago, seems to be headquarters for Edison-Lalande batteries and renewals. Among its large recent sales it mentions one of 1,000 cells to one buyer.

C. A. Munson and Frank McMaster, 623 Marquette building, Chicago, are the hustling sales agents for the Fort Wayne Electric Works. Their territory includes Iowa, Wisconsin, Nebraska, Kansas and Northern Illinois.

The question, "What becomes of the old copper wire?" is often asked by electrical men. It may be generally known that the Swarts Metal Refining company of Chicago makes a specialty of buying up old scrap-copper wire of any description, for which it pays the highest market value. Seymour Swarts, the president of the company, has a wide acquaintance among electrical men, with whom the firm has done business for many years.

The Buckeye Electric company of Cleveland is receiving encouragement in the way of increased orders for its specialty, the Buckeye incandescent lamp. It states that a certain central-station manager recently had four Buckeye lamps that had burned for nearly 6,000 hours tested for candle power. The lamps were originally of 16 candle power each, and gave 3.5 watts efficiency on a 110-volt circuit. The test showed an average of 6.6 candle power after this long service.

The recently established Eagle Electric Works of Peoria, Ill., is demonstrating by its works its right to existence. It recently secured the contract for the erection of an electric-light plant for the Town Board of Minier, Tazewell County, Ill. Another recent order is from the Illinois Beet Sugar company for an isolated plant in that company's large factory at Pekin, Ill. It is also to be noted that the Eagle company has established a new agency at Des Moines, Ia., Mr. L. L. Barge, an energetic and capable business man, being the representative in that city.

The Electric Appliance company of 92 and 94 West Van Buren street, Chicago, has recently added to its cross-arm factory a complete plant for the manufacture of pins and brackets and is now turning out this material at the rate of a good many thousand a day. The company is giving especial attention to the material used in these goods, and is turning them out with great care, so that each piece may be just as nearly perfect as it is possible to make it. Users who have had sad and costly experiences with inferior pins and brackets will appreciate the advantage of getting goods that are well made and absolutely uniform.

The Cling-surface Manufacturing company reports rapidly increasing sales, not only in this country, but also in Australia and European and South American countries, with a fast-growing business in Mexico, all seeming to prove that the truth of the oft-repeated phrase, "The days of tight belts are over," is having the backing of belt users. A recent letter from the engineer of Brown, Durrell & Co., Boston, voices this sentiment: "Having tried cling-surface on my 12-inch dynamo belt, I have been able to carry full load with 22 inches sag on belt, with no perceptible slip. It surpasses my expectations, and I can cheefully recommend it to do all that is claimed for it if directions are followed."

The Western Electrical Supply company of St. Louis reports that its spring and summer business has been exceptionally good, especially so in the sales of the Moloney transformer. This transformer is one of the most serviceable transformers on the market, embodying all the desirable features of economic distribution which experience has thus far suggested in the construction of transformers. It has never been defeated, it is said, in any competitive tests. The regulation is extremely close and the mechanical construction is claimed to be

perfect. These transformers are guaranteed for two years, and in every instance where they have been installed arc said to have given complete satisfaction.

The Maintenance company, 220 Broadway, proposes that its friends shall have a "forget-me-not" always in front of them in the shape of a handsome paperweight, and it is sending this souvenir out in quantities throughout the country. The business of the company is rapidly increasing, and it has made contracts with many of the larger manufacturers of the country. The idea of the company is to enter into contract with the manufacturer to furnish the usual guarantee for the latter's machinery. This avoids the necessity of the manufacturer having to send men all over the country, as is now the case, for trivial mishaps to the machinery. This system of insurance is well worth the closest investigation, and President McKenna is always ready to explain its merits by letter or in person.

President Richards and General Manager Corrigan of the American Electric Vehicle company of Chicago were in New York, on July 18th, remaining for several days. The American Electric Vehicle company has met with great success with its automobiles in the East, and Mr. Corrigan has his hands full looking after both eastern and western matters. Calvin B. Roulet, eastern representative of the American company, has established a temporary office in the Park Row building, New York. Mr. Roulet represented his company at the Electrical Exhibition, and the pressure of automobile business has been so great as to prevent his returning to Chicago. In fact, Mr. Roulet's success has had much to do with the establishment of a center for the company in New York. Mr. Corrigan expects to return West in a week, but President Richards will remain East for some time.

ILLUSTRATED ELECTRICAL PATENT RECORD.

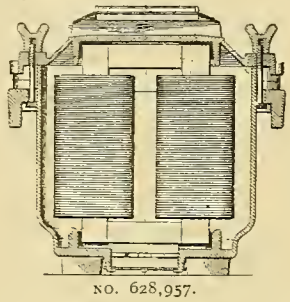
Issued July 18, 1899.

628,932. Conductor's Magnetic Check-holder. John Flinner, Standish, Kan. Application filed April 17, 1899.

A magnetic check holder, comprising a magnet secured to the interior of a car adjacent to each seat, and a check carrying at one end a metal bar which serves as an armature for the magnet.

628,957. Electric Transformer. James W. Packard, Warren, O. Application filed April 22, 1899.

A case for an electric transformer having ventilating openings in its top and bottom, and a shield or baffle plate supported from the casing in a position below the ventilating opening in the bottom thereof, is described. (See cut.)



NO. 628,957.

628,967. Electrically Driven Vehicle. Henry Van Hoevenbergh, New York, N. Y. Application filed June 2, 1897.

The vehicle is provided with a foot lever, a rack connected therewith, a brush geared to the rack, a rheostat the contacts of which are engaged by the brush, connections for short-circuiting the motor after the rheostat has been completely cut in, and a friction brake set by the lever after the motor has been short-circuited.

628,968. Electric Locomotion. Henry Van Hoevenbergh, New York, N. Y. Application filed August 31, 1897.

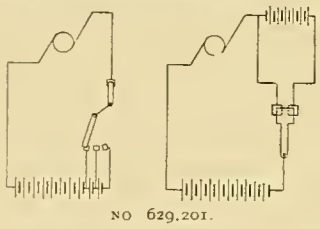
A trolley or current-collector for electrically propelled vehicles provided with an automotic brake capable of being set when the towing conductor becomes slack.

628,973. Manufacture of Incandescent Lamps. Adolphe Wierre, Paris, France. Application filed March 16, 1898.

Features enumerated are a bulb, a base adapted to fit the mouth of the bulb, leading-in wires in the base secured therein and insulated from the base and from each other by a surrounding vitreous enamel body molded with and adherent to the base and wires, and a joint uniting bulb and base formed of fusible material united by fusion both to the base and to the bulb so as to form an air-tight closure therefor.

628,982. Cigar Lighter. Augustus C. Gruhlke, Waterloo, Ind. Application filed January 6, 1899.

This is an electric cigar lighter having a current-conducting body, comprising an upper and lower member, the members having pivotal connection with each other, in combination with a block of insulating material, a metallic block inserted in the insulating material, a flat metallic spring provided at the upper edge of the metallic block, and an oscillating spark point having pivotal connection with the metallic block, this oscillating point electrically charged and arranged to form a contact with a member of the current-conducting body.



NO 629,201.

628,990. Key Socket. Charles G. Perkins, Hartford, Conn. Application filed February 13, 1899.

In a key socket, in combination, an insulating block, a bushing having a flanged end that has no support along a portion of the upper corner of the shell secured to the insulation, a key spindle rotarily supported by the insulation, and a switch block mounted upon the spindle and adapted to alternately make and break connection with the flanged end of the shell at the locality where the flange is separated from the side wall of the shell.

628,994. Automatic Carrier for Electric Wires. Frank T. Schottle and Herman C. Willitz, Sheboygan, Wis. Application filed March 3, 1899.

An automatic carrier comprising an elongated case, spring-actuated driving mechanism in the case, a pulley mounted in and projecting medially above the case and driven by the spring-actuated mechanism, and supporting pulleys mounted on the case, one at the front and another at the rear of the driven pulley, the supporting pulleys being adapted to travel on a stretched wire and hold the intermediate driven pulley up against the stretched wire.

629,022. Coin-freed Medical Battery and Appendage. Benzion Wolinski, New Haven, Conn. Application filed May 15, 1899.

In combination with the grasping handles of a medical battery and the coin-controlled detent mechanism therefor, an arm pivoted in circuit with one of the handles and normally in locking engagement with the electrode or appendage, a supporting ring for the electrode or appendage in contact with the arm, a chain connected to the appendage and passing through the ring, together with an arm on the other handle for lifting the arm to release the appendage.

629,043. Apparatus for Electrolysis. John T. Morrow, Great Falls, Mont. Application filed July 16, 1898.

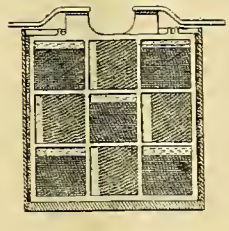
In combination with an electrolytic tank and with the anodes and cathodes thereof, a reed board, a series of reeds supported therefrom, and mechanical means for moving the reed board to and fro transversely.

629,058. Telephone Holder. Moses Wohlgemuth, Detroit, Mich. Application filed April 19, 1899.

One claim describes a telephonic attachment having a bracket, a standard fixed thereto, a bar and yoke having a sliding engagement with the standard, a lever fulcrumed in the standard and having its inner end coacting with the bar, a second lever fulcrumed in the bottom of the standard and having its upper end operatively connected to the outer end of the first lever, a third lever and a rod connecting the second and third levers, and a carrier arm pivoted to the third lever.

629,070. Apparatus for Producing Oxygen and Hydrogen. Pompeo Garuti and Riccardo Pompili, Naples, Italy. Application filed December 15, 1896.

Apparatus for producing oxygen and hydrogen by means of the electrolysis of water is described. A tank is divided in cells by means of longitudinal metallic diaphragms, the lower portion only of which is perforated, and anodes and cathodes in each of the cells formed by the diaphragms, the anodes and cathodes being suitably insulated, whereby the mixing of the gases is prevented as they pass, the oxygen being retained in the anode and the hydrogen in the cathode cells, the cells being provided with openings at the top through which the gas escapes, consisting of chambers which communicate with the cells.



NO. 629,260.

629,079. Electrically Propelled Vehicle. Rudolph M. Hunter, Philadelphia, Pa. Application filed March 4, 1899.

The vehicle is provided with a body provided with a seat, and floor in front of and at a lower level than the seat, and a battery compartment built into and as a part of the body portion immediately below the floor and forward of the seat of the full width of the body, and a removable battery support adapted to this compartment.

629,130. Electrical Measuring Instrument. Edward W. Jewell, Chicago, Ill. Application filed May 18, 1899.

According to the first claim, the combination with an electrical measuring-instrument casing, of magnet windings mounted therein, and a scale-pan rotatably mounted upon the casing independently of the magnet windings.

629,153. Electric Heater. Mark W. Dewey, Syracuse, N. Y. Application filed April 24, 1895. Renewed October 11, 1897.

The combination of a resistance spiral and two insulated plates, the plates arranged one on each side of the spiral and adapted to clamp the same between them, the plates being spaced apart for the circulation of air therebetween.

629,163. Telephone System. Robert J. Hewett, St. Louis, Mo. Application filed April 8, 1898.

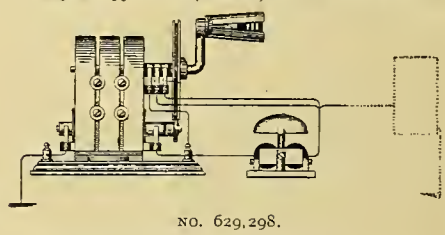
This system comprises a metallic talking circuit having a plurality of subscribers' telephone sets in multiple-arc relation between the line wires, calling generators in multiple-arc relation to one line wire and earth at the several subscribers' stations, the connections for the generators at some stations being with one line wire and at other stations with the other line wire, bells at the subscribers' stations connected with each line wire, these bells being of different tone, and a monitor station having call receiving and transmitting apparatus responsive to either line wire.

629,198. Incandescent Lamp. Andrew H. Miller, Central City, Colo. Application filed September 22, 1898.

The lamp described has a base with a positive contact point, a filament, a leader passing from the positive contact point, a contact finger with which the leader is connected, a second contact finger, a leader passing from the second contact finger and connected with a filament at a point intermediate the length thereof, a leader passing from one end of the filament to the base sheathing, a third contact finger, a leader between the third contact finger and the remaining end of the filament, a fourth contact finger, a leader between the fourth contact finger and the base sheathing, a ring turning on the base, and contact wires held on and moving with the ring and coacting with the several contact fingers.

629,201. Means for Preventing Sparking when Making and Breaking Electric Circuits. Adolph Müller, Hagen, Germany. Application filed July 13, 1898.

Consumption apparatus is arranged in the circuit, and a polarizing battery consisting of such a number of cells that it will become polarized up to a higher potential than the difference of potential between the source of current and the consumption apparatus, the polarizing battery being in series with the source of electricity and with the consumption apparatus. (See cut.)



NO. 629,298.

629,211. Electric Railway. Charles Russell, Sharon Hill, and Albert C. Welchaus, Lancaster, Pa. Application filed August 2, 1898.

An electric railway comprising a plurality of transverse ties, parallel rails adjacent each end thereof, insulator sockets attached to some of the ties, petticoat insulators supported by the sockets, and having upwardly extending projections above the petticoats, the projections having vertical openings, a trolley rail with a depending web fitting in these vertical openings, U-shaped guard-rail chairs attached to some of the ties and having upwardly and inwardly extending faces, wood guard rails connected to the inclined faces of the chairs with their upper edges projecting above and adjacent the upper edge of the trolley rail, and their lower edges projecting below the depending flange thereof but considerably above the tie.

629,260. Electrode for Storage Batteries. Charles W. Kennedy, Rutledge, Pa. Application filed April 30, 1898.

An electrode for a storage battery, consisting of several parallel series of masses of active material, one series being vertically above another, each mass comprising a series of parallel strips of lead tape, the strips in one mass extending at right angles to the strips in the next adjacent masses, and a frame or holder supporting all of the masses. (See cut.)

629,291. Electric Arc Lamp. Francis G. Hall, Jr., and Irving E. Burdick, Dansville, N. Y. Application filed October 6, 1898.

This is a submarine arc lamp. The fourth claim reads: In combination with an arc lamp, a water-tight and pressure-proof inclosing case wherein an arc of high candle power may be produced at considerable depths under water, the case comprising a glass globe inclosing the arc, a metallic case inclosing and supporting the lamp mechanism, a water-tight coupling between the two, also a water-tight passage between the two for the upper carbon and a current conductor to the lower carbon and a water-tight packing box through which the current conductors enter the mechanism chamber.

NO. 31,238.

629,298. Electrical Signaling Apparatus. Charles E. Kells, Jr., New Orleans, La. Application filed October 15, 1898.

The combination of a magneto-generator, a signaling circuit connecting the magneto with a distant station, a signal bell included in the circuit when the magneto is at rest, and devices within the handle of the magneto for cutting out the signal bell from the circuit whenever the magneto is operated to send a signal to a distant station. (See cut.)

629,302. Apparatus for Operating Electric Signals for Elevators. Henry Pedersen, New York, N. Y. Application filed February 11, 1899.

Apparatus for electrically signaling to ascending or descending elevator cars from any floor of a building is described.

DESIGN.

31,238. Field-magnet Frame. Warren P. Freeman, New York, N. Y. Application filed April 10, 1899.

The design for a field-magnet frame shown in the cut.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, AUGUST 5, 1899. No. 6

People's Light and Power Company's Plant in Newark, N. J.

A disastrous fire in December, 1896, destroyed the Newark power house of the People's Light and Power company. In the following year the reconstruction was commenced, and the building shown in Fig. 1 was erected. Some novel features have been introduced in the new equipment, which exhibits much of interest to the engineer.

The generating plant consists of two 850-kilowatt, two-phase Westinghouse alternating-current machines. These machines have 80 poles, generating 2,400 volts at 7,200 alternations at a speed of 90 revolutions per minute. Unlike the usual type of generators, the armatures of the machines are fixed and the fields rotate. A view of one of these generators with its engine is shown in Fig. 2. The generators are direct-connected to Corliss cross-compound, condensing engines, and are arranged to work in parallel. When the load increases, becoming too heavy for one generator, the other is switched in. The two generators have identical wave forms and work in exact synchronism. This is a feat in engineering which reflects credit upon the Westinghouse engineers and constructors. Fig. 3 shows the rotating field while under construction at the works of the Westinghouse Electric and Manufacturing company at Pittsburg.

Fig. 3. Rotating-field Alternator under Construction.

These 850-kilowatt dynamos are excited through a collector on the shafts. They were specially designed to have a higher all-round efficiency than is customary and to possess a larger margin for overload than the standard machines. They are guaranteed to carry their full-rated loads at a rise in temperature not to exceed 35 degrees Centigrade in any part of the machine and a continuous overload of 60 per cent. with a total rise in temperature not to exceed 60 degrees Centigrade, and to carry an overload of 75 per cent. for one hour with a total rise in temperature not to exceed 75 degrees Centigrade. The generators supply current for incandescent lighting. They are excited by two 62-kilowatt Westinghouse generators, direct-connected to 8 by 14½ by 10½-inch tandem-compound engines, run at a speed of 275 revolutions per minute. These exciters are run in parallel, and each is of sufficient capacity to excite all the alternators and light the station. There is also one 20 by 40 by 48-inch cross-compound engine, direct-connected to a 500-kilowatt, 500-volt Westinghouse direct-current generator, which is used to supply the current for the power circuits, running at a speed of 90 revolutions per minute.

A third 850-kilowatt, two-phase Westinghouse generator is under construction for this plant and will shortly be installed. This will be arranged to work in parallel with the two now in use.

What is designated as engine room No. 2 of the Newark station is devoted to arc lighting. Eighteen 125-light Brush machines furnish the larger part of the current to 2,700 arc lights. Fourteen of these arc machines are belted to a shaft, which is driven by a 26 by 48 by 60-inch cross-compound, condensing engine. There are also in this room two 18½ by 31 by 16-inch cross-compound condensing engines. One of these engines drives four arc machines. The other drives one day arc machine, one 250-kilowatt direct-current Westinghouse generator used for power and a 75-kilowatt direct-current Westinghouse 220-volt power generator.

In the annex to engine room No. 2 is a Westinghouse two-phase, 2,000-volt, 200 horse power alternating-current induction motor, which is directly connected by means of flexible couplings at each end of the shaft to two 125-light Brush arc machines, used to operate day arc lights. This combination is shown in Fig. 4, page 74. All the conductors in engine room No. 2 are lead covered, run in conduits of the National Conduit and Cable company's manufacture, under the concrete floor.

In the gallery of the engine room is the switchboard, erected by the Westinghouse company. It is of a very elaborate character, consisting of two exciter panels, one station-lighting panel, three alternating-current generator panels, eight double incandescent-circuit panels, two 500-volt direct-current generator panels, two 500-volt panels and one two-phase panel. The generators are all connected to their respective panels by heavy insulated cables, which are supported by porcelain insulators set in iron racks secured to I-beams, there being six conductors to each generator. Wires are run under the floor, except where they rise on the side wall at one end of the gallery, running to the I-beams which support the gallery to their respective panels, to which they are connected through a slot in the slate floor. Fig. 5 shows the front of switchboard and Fig. 6 the rear view.

Fig. 1. New Station.

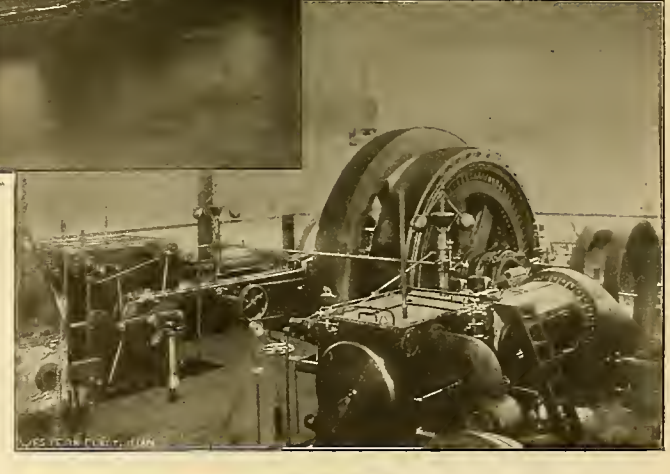


Fig. 2. Rotating-field Alternating-current Unit of 850 Kilowatts.

PEOPLE'S LIGHT AND POWER COMPANY'S PLANT AT NEWARK, N. J.

The primary object in designing the alternating-current switchboard was to adapt it for parallel running. Duplicate sets of two-phase bus-bars have been provided, and the generator and feeder panels are equipped with double-throw switches. Any generator can, therefore, be run separately from the others, and any feeder operated from it should the nature of the load make it desirable to do so. All switches, connections and wiring are behind the board. Upon the face of the board are mounted only the switchboard instruments and the handles which control the switches themselves. The generator panels contain the necessary synchronizer devices, with an ammeter and an indicating voltmeter for each phase. A direct-current ammeter is provided for the field circuit. Voltmeters are mounted on swinging arms at the end of the board. Each feeder circuit is provided with an ammeter and recording wattmeter. Circuit regulators are also provided with compensating voltmeters and Mershon compensators. The 500-volt panels are provided with voltmeters and ammeters and circuit-breakers. The lighting and power circuits are run from their respective panels along the under side of the gallery to iron racks, whence they are run through slate slabs located in windows.

The sub-station at Mechanic street is situated about a mile from the Newark power house. The 2,400-volt current is conveyed by overhead conductors to this sub-station. The installation includes a 300-kilowatt, 220-volt, Westinghouse rotary converter, which receives the alternating current at 2,400 volts through transformers, and delivers direct current for motors at both 110 volts and 220 volts. Power from this sub-station is supplied to several establishments, driving electric motors in mills, hat and shirt factories, jewelry shops and printing plants.

Electrical Service Needed in Ecuador.

The following extracts are from a letter by Consul-general De Leon, dated Guayaquil, June 12, 1899, to a New York firm:

There is no electric power used in Guayaquil and no demand for electrical supplies. I believe, however, that there is an excellent opening for an electric-light and street-railway service. This is a prosperous city of about 50,000 inhabitants, and with the construction of the proposed railway to Quito is bound to increase in population and wealth. It is at present lighted by gas of poor quality, which costs the municipality a considerable sum annually. A street-car system traverses almost every street; but mules, the motive power, are costly.

The finances of the municipality are in a flourishing condition. The stock of the car company was at 50 in 1896; there is now a large cash reserve equal to 50 per cent. of capitalization; 15 per cent. annual dividends are declared, and the stock brings to-day $150 a share.

Fuel is scarce and expensive, but superb water power is available at some distance from the city. In 1896 the installation of an electric-light service was in progress; but the great fire, which burned 83 blocks of the best part of the city, destroyed the work and caused the enterprise to be abandoned. The city is almost rebuilt, with a better class of edifices, and the time seems ripe for a system combining transportation and illumination.

P. G. Shook and associates of Ensley, Ala., have received a franchise for electric lighting.

Electric Railroads for London.

[From the Railroad Gazette.]

Parliamentary committees have during the last few weeks considered in exhaustive detail the Great Northern and Strand and the Baker Street and Waterloo extension bills. The former proposal is for an electric line from Wood Green to the Strand. It will consist of four separate railroads. The first will be from Wood Green to Finsbury Park, and will be one mile three furlongs and 9.5 chains in length. Number two will be from Finsbury Park to King's Cross, and the whole of that section will be practically beneath the present line of the Great Northern, with which the new company is really affiliated. The tunnel will be very expensive, for it must be made strong enough to bear the Great Western trains, and it has to be constructed in such a way as not to impede the traffic of the Great Northern. From King's Cross to Holborn the line must pass beneath private property at great depth. At Holborn it will cross the Central London Electric and proceed thence to the Strand terminus. The total length will be six miles, two furlongs and seven chains, and the cost in the neighborhood of $12,000,000. The Great Northern finds itself quite unable to adequately deal with the enormous suburban traffic, hence this new scheme, which will render considerable assistance in coping with it.

The other bill, the Baker Street and Waterloo, is for an extension of an already authorized line, from Baker street to Paddington and St. Pancras. The bill asks for power to raise about $9,000,000, and this includes various subways for establishing connections between the stations of other railroads.

In the course of the evidence given in regard to this scheme, statements were made by Sir Benjamin Baker, Sir J. Wolfe Barry and Sir W. H. Preece which doubtless possess considerable interest for New York. The heavy cost of these lines handicaps them when they come to the investing public for capital. More than once the public has failed to subscribe the necessary money for carrying out the works, although interest was guaranteed previous to the running of the line. As to costs, these, according to Sir Benjamin Baker, are estimated as follows: The Central London, $2,925,000 per mile; Baker Street and Waterloo, $2,875,000 per mile; Great Northern and City, $3,260,000; North West London (another scheme recently brought before Parliament), $2,425,000 per mile; Great Northern and Strand, $2,510,000 per mile. These figures include stations, subways, electric lights, professional charges and working capital.

Sir J. Wolfe Barry and Sir W. H. Preece gave evidence against the scheme on behalf of the Metropolitan Railway and District Railway companies, which opposed the extensions because they would result in the establishment of a direct competitive service. The Metropolitan experiments with electric traction were referred to at length. These two gentlemen are supervising the experiments which were described as the first real practical trials of electrical traction for full-sized stock that had ever been made in England. The engine and dynamos are now being erected near Earl's Court, and conductors are being laid on the rails to Kensington Station, and in a few months a train will be running. The object, as explained by Sir J. W. Barry, is not to convince Sir William Preece or himself of the practicability of working the Metropolitan service electrically, but before so large a change is made they had determined to thoroughly satisfy themselves that they had got the best kind of rolling stock and the best kind of conductors, and that they should gradually habituate the employes and staff to the electrical mode of traction. With electrical traction it is declared that about a third more than the present number of trains will be accommodated. Sir William Preece's evidence was to the effect that electrical working would free the tunnels from foul air, and the increase of temperature in the tunnels of 10 degrees or 12 degrees would be done away with. The present mean rate of traveling on the inner circle of 11.2 miles an hour will be increased to at least 14 miles. The present time occupied by the journey round the whole inner circle will be reduced from 70 to less than 50 minutes, and in that way eight new trains may be brought into service.

The London County Council this year assumed possession and control of over 70 miles of street tramways and is now seriously engaged in considering what method of electrical working shall be adopted, in order that a cheaper, more rapid, extensive and convenient service of passenger traffic may be introduced in the suburbs of London. Professor A. B. W. Kennedy was recently commissioned by the London County Council to investigate completely the various systems used for such busy towns as London, both in America and on the continent. After several weeks' tour, inspecting the principal electrical systems in the States and at Brussels, etc., he has returned to prepare his report. This is being awaited with great interest. Meanwhile the London County Council has been trying to get a bill through Parliament for the equipment of lines on the electric trolley, conduit or surface-contact methds, and proposing to dispense with the sanction of the various local authorities through whose districts the new lines would run. But the scheme did not succeed. While Professor Kennedy's report is being awaited, however, a member of the council, Mr. Baker, who last year also made an extensive tour of inspecting the electric-traction systems of the States, comes forward with a proposal which affects the very heart of the city of London. It amounts to this: That the council investigate the practicability of constructing a "shallow underground electric tramway" from Westminster (via Parliament street, Strand, Fleet street and Cheapside) to the Bank, on a similar principle to those laid under Andrassy strasse, Budapest, and in Boston. This proposal will hardly receive serious consideration at the hands of the council.

The electric trolley lines of the London United Tramways company are being pushed forward with all speed and it is expected that by about August one section will be running. At present there is no trolley line in existence nearer to London than Dover: hence the remarkable ignorance displayed by the great majority of Londoners when they talk about the trolley, which they have never seen.

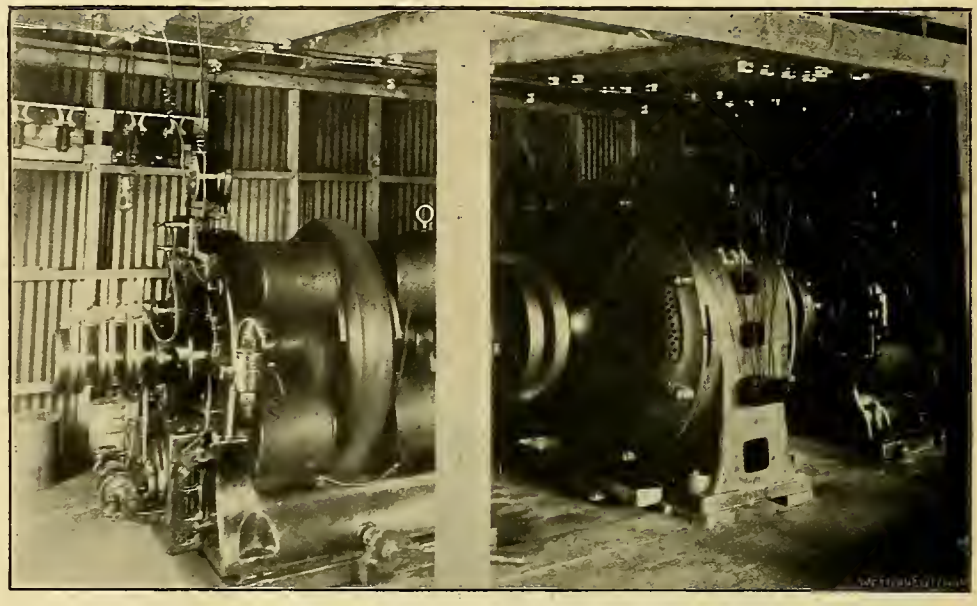


FIG. 4. PEOPLE'S LIGHT AND POWER COMPANY'S PLANT IN NEWARK, N. J.—200 HORSE POWER INDUCTION MOTOR DRIVING ARC MACHINES.

FIGS. 5 AND 6. PEOPLE'S LIGHT AND POWER COMPANY'S PLANT IN NEWARK, N. J.—FRONT AND REAR VIEW OF SWITCHBOARD.

Influence of Mechanical Draft Upon the Ultimate Efficiency of Steam Boilers.[1]

By Walter B. Snow.

In the curves (Fig. 1, page 75) are presented the relative costs of chimneys and of equivalent mechanical-draft equipments in a number of boiler plants widely different in character and rated capacity. In certain of these the cost of the existing chimney is known and that of the complete mechanical-draft plant is estimated, while in others the cost of mechanical-draft installation is determined from the contract price and the expense of a chimney to produce equivalent results is calculated. Costs are shown for both single, forced and induced engine-driven fans and for duplex engine-driven plants, in which either fan may serve as a relay. An apparatus of this latter type is evidently most complete and is necessarily the most expensive. It finds its greatest use where economizers are employed.

An average of the costs for these nine representative plants shows the total expense for installing a forced-draft plant to be only 18.7 per cent.; that of a single induced fan and accessories 26.7 per cent., and that of a complete duplex induced-draft plant 42 per cent. of that of a chimney. In each case a short steel-plate stack is included.

In other words, if a chimney be estimated to cost $10,000, there could be saved, on a basis of these averages, the respective amounts of $8,130, $7,330 or $5,800 in the first cost, according to which system of mechanical draft is substituted.

For a good steam-boiler plant it is fair to assume the following as average fixed charges:

Interest	5	per cent.
Depreciation and repairs	4½	"
Insurance and taxes	1½	"
Total	11	per cent.

Experience has shown that these figures also hold good for a well-designed mechanical-draft apparatus, and are, therefore, so accepted here.

On the other hand, the fixed charges on a chimney may be fairly assumed as:

Interest	5	per cent.
Depreciation and repairs	1½	"
Insurance and taxes	1½	"
Total	8	per cent.

In summarized form, the comparative costs and fixed charges on a $10,000 chimney and on the equiv-

1. Extract from lecture delivered before the Engineering Society of Columbia University. Mr. Snow is attached to the engineering staff of the B. F. Sturtevant company, and takes the mechanical-draft side of the discussion as to the most efficient method of producing draft in steam plants.

alent mechanical-draft plants of various types will be as indicated in the table:

COMPARISON OF COSTS AND FIXED CHARGES.

Method of draft production.	First Cost.		Annual Fixed Charges.	
	Amount	Ratio.	Amount	Ratio.
Chimney	$10,000	1.00	$800	1.00
Induced Draft Plant (2-fan)	4,200	.42	462	.58
Induced Draft Plant (1-fan)	2,670	.267	294	.37
Forced Draft Plant (1-fan)	1,870	.187	206	.26

The fact that the mechanical-draft apparatus can usually be placed overhead or on top of the boilers, where it occupies no valuable space, and that the space otherwise occupied by the chimney is at the same time rendered available, makes possible a further saving, which is necessarily dependent upon land values. Within city limits, it may readily amount to $1,000 in a plant of a thousand horse power.

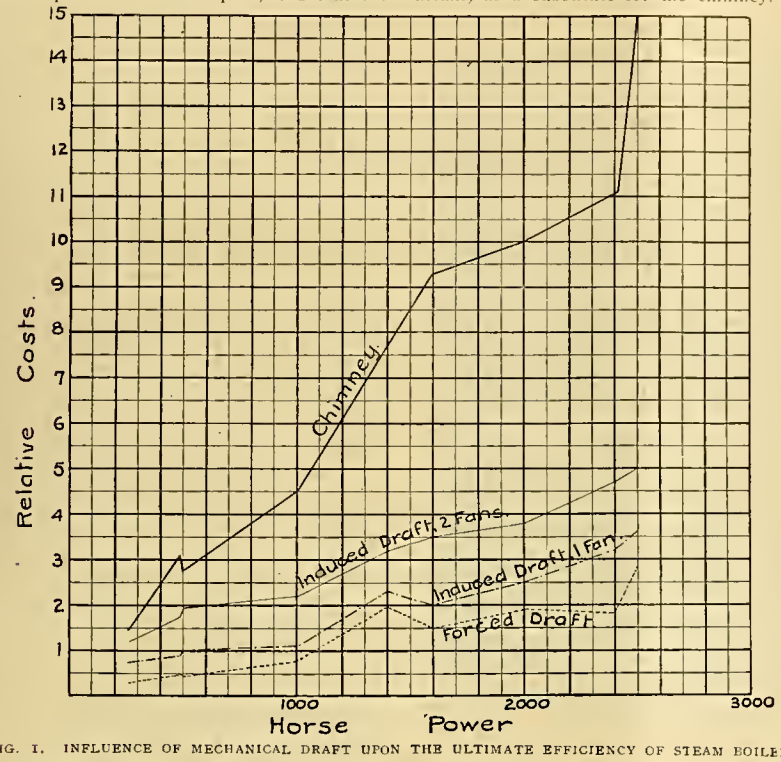


FIG. 1. INFLUENCE OF MECHANICAL DRAFT UPON THE ULTIMATE EFFICIENCY OF STEAM BOILERS.

A concrete case, illustrating the possibilities of mechanical draft, is presented in the accompanying drawings (Figs. 2 and 3). These show a plant of 2,400 horse power of modern water-tube boilers, 12 in number, set in pairs and equipped with economizers. Fig. 2 indicates the location of a chimney, nine feet in internal diameter by 180 feet high, designed to furnish the necessary draft. Fig. 3 represents the same plant with a complete duplex induced-draft apparatus substituted for the chimney and placed above the economizer connections. Each of the two fans is driven by a special engine, direct-connected to the fan shaft, and each is capable of producing draft for the entire plant. A short steel-plate stack unites the two fan outlets and discharges the gases just above the boiler-house roof. All of the room necessary for the chimney is saved and no valuable space is required for the fans.

In round numbers the cost of the plant is, in detail, as here shown:

COST OF BOILER PLANT WITH CHIMNEY.

12 boilers	$37,000
Two economizers	10,500
Boiler and economizer settings and by-passes	9,000
Automatic damper regulators and dampers	400
Chimney, including foundations	10,700
Boiler house	11,500
Total	$79,100

RELATIVE COSTS.

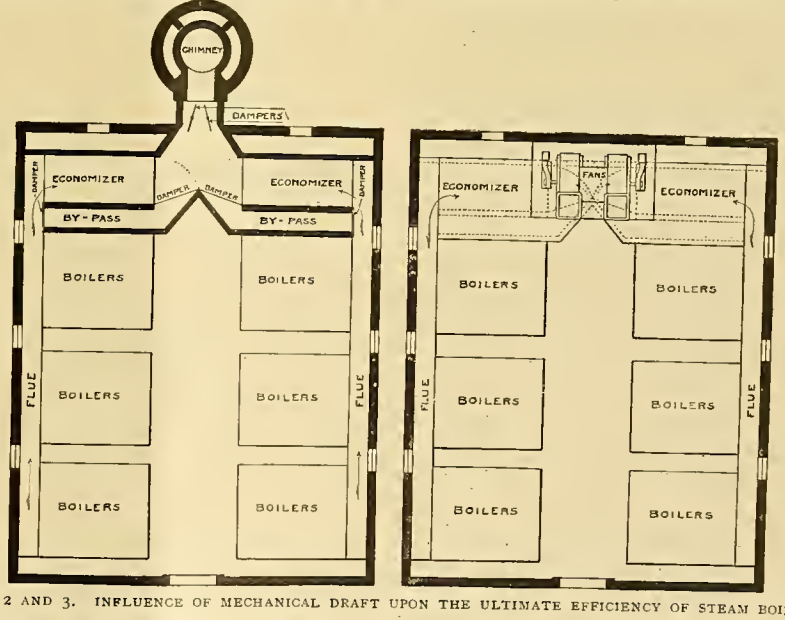
Chimney Draft.		*Mechanical Draft.*	
Cost of chimney	$10,700	Cost of mechanical-draft plant complete	$ 4,700
Cost of damper regulators and dampers	400	Saving by using mechanical draft	6,400
	$11,100		$11,100

The costs of the chimney and the mechanical-draft apparatus, which are also indicated, show a saving in first cost of $6,400 as the result of using the mechanical-draft method.

The intensity of draft produced by a fan and the readiness and economy with which it may be secured make it a simple matter to maintain a combustion rate higher than that ordinarily obtained with a chimney.

The comparatively low rates of combustion which have heretofore obtained are largely due to the inability of the ordinary chimney to overcome the increased resistances incident to the maintenance of a higher rate. Boilers have been proportioned to meet these conditions, but it is manifest that, by changes in design or by the introduction of heat abstractors, they may, under the influence of mechanical draft, be readily operated at considerably above their original ratings, with substantially the same efficiency. As a result, it is possible to obtain a given output with a plant of less size and first cost than is possible with a chimney. This is particularly true where the steam consumption is liable to sudden fluctuations for comparatively short periods.

The typical boiler plant already presented will serve as an excellent illustration. Suppose it is determined to omit two of the 12 boilers, say one from each pair at the end farthest from the economizers, and to force the remaining boilers up to the original rating, which can be easily done by mechanical means, as a substitute for the chimney. This will decrease the rating to 2,000 horse power, or by 16⅔ per cent. The volume of air required per pound of coal, with the higher combustion rate, deeper fires and mechanical draft under automatic control, will be somewhat less than that with the chimney, while, if the economizers remain the same, their capacity relative to the heating surface of the boiler will be greater, so that the ultimate waste by heat in the escaping gases will certainly not be increased.



FIGS. 2 AND 3. INFLUENCE OF MECHANICAL DRAFT UPON THE ULTIMATE EFFICIENCY OF STEAM BOILERS.

RELATIVE COSTS.

2,400 Nominal Horse Power Plant, with Chimney Draft.		*2,000 Nominal Horse Power Plant, with Mechanical Draft.*	
12 boilers	$37,000	10 boilers	$30,833
Two economizers	10,500	Two economizers	10,500
Boiler and economizer settings and by-passes	9,000	Boiler and economizer settings and by-passes	8,500
Automatic damper regulators and dampers	400	Boiler house	11,000
Chimney, including foundations	10,700	Mechanical-draft plant complete	4,700
Boiler house	11,500	Savings by using mechanical draft	13,567
	$79,100		$79,100

The original costs under the two conditions will be about as indicated in the table given. A total possible saving of $13,567 is thus shown, of which $7,167 is due to the reduction in nominal horse power made possible by the introduction of mechanical draft.

This points to one of the most important advantages of mechanical draft in connection with a plant subject to temporary demands for excessive capacity, as is, for instance, the case in the power plant of electric railway. For the sudden demand can be met by forcing the boilers by mechanical draft far above their rated capacity, instead of by installing reserve boilers to meet these special requirement.

A problem that has to be faced sooner or later in most boiler plants is that of increased capacity. This differs from that just presented, in that the chimney already exists, and it becomes a question whether the desired result shall be obtained by forcing the existing boilers or by adding to their number. The former method demands an increase in intensity of draft, which, with a given chimney, operating well up to its capacity, can only be obtained by considerable increase of height at excessive expense, while, with either method, a larger volume of air is required. As a result, increased output frequently demands not only more boilers, but a new or higher chimney. Here mechanical draft steps in and presents a simple solution of the problem.

Considering the matter of increased output solely in the light of comparative cost between the introduction of more boilers or the introduction of mechanical draft, and disregarding any possible cost of change in the chimney, we may again take for illustration the plant of 2,400 rated horse power. Suppose it is desired to increase its capacity to 2,800 horse power, or by 16⅔ per cent. Then the relative costs under the two conditions will appear as here indicated:

RELATIVE COSTS.

2,800 Nominal Horse Power Plant, with Chimney Draft.		*2,400 Nominal Horse Power Plant with Mechanical Draft.*	
Two additional boilers	$ 6,167	Fan, dampers and ducts	$ 1,500
Settings, etc., for two boilers	1,250	Saving by using mechanical draft	8,617
Addition to building, etc.	2,700		
	$10,117		$10,117

Chicago Union Traction Company.

George A. Yuille, formerly second vice-president and assistant general manager of the West Chicago Street Railroad company, has been appointed assistant general manager of the Chicago Union Traction company, and T. A. Henderson and F. L. Fuller are the new superintendents, respectively, of the North and West divisions.

It is announced that the shares of the company will be regularly listed within a short time on the Chicago and New York Stock Exchanges. The expectation is that there will be very active trading in the securities, for a time at least, as soon as they have been admitted to quotation. Sales of the common shares were made on the curb last week at 32, while the preferred was taken in limited quantities at 83.

Traffic on the North and West Side lines is heavy, and the new company is adding 50 cars to the morning and evening service on the Clark street, Wells street, Milwaukee avenue, Madison street and Twelfth street lines. An effort is being made to give the people the service that is demanded.

Mr. George Truesdell has been elected president of the Washington Traction and Electric Street Railroad company of Washington, D. C. Other officers were chosen as follows: Vice-president, Charles A. Lieb; treasurer, H. D. Mirick; secretary, James B. Lackey; assistant treasurer, V. B. Deyber.

Electric Rail Welding in Buffalo.

The International Traction company of Buffalo is having about 50 miles of its track in the city of Buffalo electrically welded by a plant owned by the Lorain Steel company of Lorain, O., and Johnstown, Pa. This plant is in charge of H. F. A. Kleinschmidt as superintendent, with B. C. Shipman as foreman. It consists of five cars, one of which is a sand-blast car that moves in advance of the welding car to prepare the joint. The welder car, the transformer car, motor and booster car and a car that follows in the rear to dress the joints by an application of emery wheels when necessary, make up the remainder of the plant. The welder car, the transformer car and the booster car are shown in the illustrations. These three cars are coupled together, the coupling between the welder car and the transformer car being so arranged that the first-named car can be moved several inches back or forward in order to cover the space about the welds without disturbing the other cars. The cars move over the line by power taken from the trolley wire, from which source the current for welding is also obtained.

FIG. 1. ELECTRIC RAIL WELDING IN BUFFALO.—THE WELDING TRAIN.

While at work in a street the plant creates no great disturbance, and the welds are made quite rapidly. In streets where it is desired to weld the joints of an old track, the pavement is opened for a space about two by two feet, and in the case of new track this space can be left in the pavement until the welding is done. The joint offers no interference with the pavement, as the bar used is flat and lies close to the web of the rail.

While credit is given Mr. A. J. Moxham for the success of the method used in welding, it was Mr. Kleinschmidt, who, in attempting to prevent the spread of the heat after making the weld, discovered the process which is said to wholly overcome any change in the structure of the steel, while it also produces a weld of great strength. This process consists in making the weld from a boss on the bar instead of from a flat bar. In making a weld one bar is placed each side of the rail web, and, the bars having bosses on them, the boss is the only part of the bar that touches the rail. The bars in position, the clamps of the welding machine are applied to them and the pressure run up to about 1,400 pounds by means of a hydraulic jack located over the welder. The mechanical pressure is applied, the current is turned on, and then the metal between the welder grows brighter and brighter, until a welding heat is obtained. When this occurs the current is turned off and the mechanical pressure on the weld is immediately increased to a very great extent. At the same time artificial means are employed for cooling the weld while under this enormous pressure. It is found that the comparatively cool portions of the welding bar about the boss serve to confine the plastic metal and prevent it from spreading, and while it is cooling the pressure prevents coarse crystallization. The effect is stated to be the same as though the metal had been hammered. At a joint the center weld is made first, and then the end welds, and it is here that the possibility of moving the welder car a short distance without disturbing the other cars is found effective.

In the accompanying diagram (Fig. 4) is given a good idea of the course of the current. It will be noted that it comes down the trolley through an ammeter (A), and passes thence through a circuit-breaker (not shown), and through armature (M) of the motor end of the booster, and then by one course through armature and field of generator end of booster to ground. By the other path the current passes through the rotary transformer to ground. The alternating current from the rotary is led through a switch and choke coil to the stationary transformer (T) between the welder jaws, the secondary of which consists of one turn of copper. The terminals of the secondary are the clamps that grip the weld. A rheostat (FR) is shown in the field circuit of the motor end of booster, by which the attendant in charge can make the machine boost any amount desired to compensate for any lack of line voltage. The voltage for welding is about 500, but good welding is said to have been done with a voltage as low as 300.

Of the 50 miles of track to be welded in Buffalo about 25 miles is of 60-foot nine-inch rail. As to the cost, it is said that it is less than for any other form of weld, especially with the nine-inch girder rail. The Lorain company's process appears to heat the head of the rail in a comparatively small degree, thus avoiding softening. It is estimated that a continuous rail joint should equal the rail itself in point of service. As a bond the welded joint is said to do way with all danger of electrolysis.

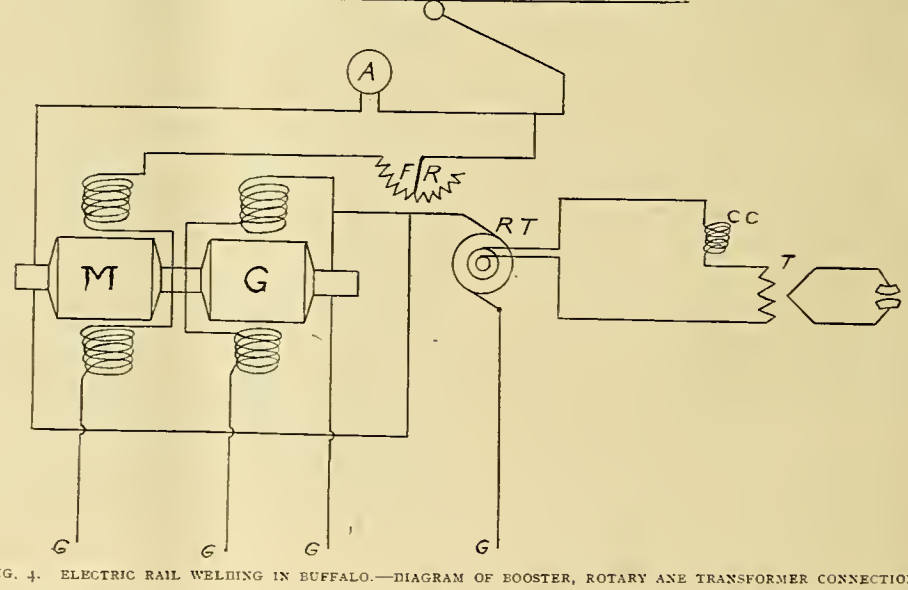


FIG. 4. ELECTRIC RAIL WELDING IN BUFFALO.—DIAGRAM OF BOOSTER, ROTARY ANE TRANSFORMER CONNECTIONS.

Trouble in Breckenridge.

Inexperienced men are especially out of place when put in charge of electric-light plants. The Minneapolis correspondent of the Western Electrician tells of the misbaps of a Minnesota town in consequence of this error:

"The city of Breckenridge, Minn., let the engineer of the electric-light plant go for neglecting to pump the tank full on two occasions. Once the delinquent left the tank dry when he went off duty in the morning. There was put in his place a locomotive fireman, who has, since he has been running nights, allowed the oil cups of the dynamo to run dry on two occasions, once burning out the babbitt and causing a two-days' shutdown, and once taking the temper out of the shaft.

Operating Costs of Horse and Electric Delivery Wagons in New York City.[1]

By G. F. Sever and R. A. Fliess

In considering the advantages and disadvantages of two radically different systems for the performance of the same work, other things being equal, the cost is the deciding factor. Assuming that all other considerations are equal, it will be shown that the cost of operation, maintenance, etc., of the electric automobile is less than for horses in the light-delivery service of New York city, the horse being considered in the most favorable light.

From actual tests we are led to the conclusion that, under highly disadvantageous conditions, the power necessary to propel a vehicle through the streets of New York city from the lower part of the town to points situated on the highest ground, including all grades that may be encountered, will not average more than 120 watt-hours per ton-mile. That this is a high figure for vehicles of good design and equipment is evident from the results obtained while testing a delivery wagon built for a large dry-goods store in New York city. The fact that the small carriage never reached 120 watt-hours per ton-mile, though working under most unfavorable conditions, should lend weight to this conclusion.

Taking 120 watt-hours per ton-mile as a basis on which to compute the power consumed by an electric delivery wagon, we will compare the results where two horses and a delivery wagon are considered with the results that would be obtained if an electric wagon were substituted. It was found that the total cost per day for two horses, one driver and one boy, was 428.54 cents. The wagon was to travel 42 miles a day—being an average of 21 miles per day for each horse. The time in motion was assumed to be six hours. An electric wagon with an average speed of nine miles an hour could cover this distance in 4.66 hours, thus saving 1.34 hours—the other conditions remaining the same. The cost per day for the electric wagon, assuming cost of power at five cents per kilowatt-hour, is as follows:

1. Cost of power for 42-mile run, at 5c. per k. w. hour..... 71.28c
   Assuming power consumption as 120 watt-hours per ton-mile.
   Weight of wagon.....3,750 lb.
   Weight of driver..... 150 lb.
   Weight of boy..... 125 lb.
   Average load..... 500 lb.
   Total weight.....4,525 lb.
   2.263 tons.
   Watt-hours per car-mile, 271.56
   Watt-hours per 42 car-miles, 11,405.00=11,405 k. w. hours.
   Taking battery efficiency as 80 per cent.
   Total power to be paid for=14,256 k. w. hours.
2. Interest on cost of wagon per day..... 21.4c.
   Cost of wagon, $2,300, at 6 per cent interest.
3. Interest on stable rent for one wagon..... 9.39
4. Driver.....171.42
5. Boy.....114.28

Total cost per day for 42 miles, one wagon, one driver and one boy .....387.77c.

Therefore, cost per pound of delivery is .16158 cent, or .01698 cent less than the figures for the horse. The cost per car-mile is 9.232 cents, or .968 cent less than for the horse. Cost per ton-mile is 4.08 cents, or 6.12 cents less than for the horse service. If we consider the load only, it costs 9.232 cents per 500 pounds per mile, or at the rate of .018464 cent per pound per mile, or .00194 cent less per pound than for the horse service.

Attention is again called to the conditions under which this comparison is made. The horse is supposed to be able to average 21 miles per day, doing this at the rate of seven miles per hour, under a draw-bar pull of 50 pounds. In other words, he is doing work at the rate of .89 of a theoretical horse power for three hours per day. The automobile, on the other hand, is to do 42 miles a day at the rate

1. Part of paper presented at the general meeting of the American Institute of Electrical Engineers, Boston, June 28, 1899.

of nine miles per hour, and the cost of power is assumed to be five cents per kilowatt-hour. Under these conditions the automobile can do the work of two horses in 1.34 hours less time than they can do it with a saving of .01698 cent per pound of goods delivered, or at a saving of 40.752 cents per day on a delivery of 2,400 pounds.

Now, having shown that it is cheaper to use an electric delivery wagon than the present horse delivery wagon—even when the supposition is made that the horse is doing much more work than he really is—it is proposed to make a comparison between the two systems under conditions which actually exist to-day. It has been shown that the delivery horse does not average 18 miles per day during the year. We will assume, however, that the horse does travel this distance per day. Each wagon will go 36 miles a day under this assumption; hence, the total mileage of the wagon for the year will be 11,268 miles. This assumes that on Sundays the wagon does not go out. Then for 52 days a year, at least, the horses have to be fed without any work in return. This, of course, is a condition not met in electric automobile service.

The cost per day for the two horses, wagon, driver, etc., necessary to accomplish 36 miles a day was found to be 428.54 cents. The cost of covering 11,268 miles will then be $1,562.20. Here it must be remembered that 365 days have to be taken. The cost per car-mile is then 13.86 cents.

When we come to consider the electric automobile for a year, covering 36 miles a day, its advantages are brought out very clearly. Since the vehicle, owing to the nature of its construction, does not consume any energy when not in motion, it follows that, during the periods of rest, while deliveries are being made and the wagon is being loaded, there is no more expense than that incidental to wear and tear. This, of course, is common in amount to all vehicles of the same class and may be considered the same in each case. That a slight loss does occur when the vehicle is at rest, due to local action, etc., in the batteries, is true, but this loss is considered when the efficiency of the battery is taken at 80 per cent. We may say, then, that the factor most important in determining the expense of operating an electric vehicle is the price that must be paid for the power. This is a very variable factor, indeed, and the price per kilowatt-hour will determine in all cases the amount of saving that will be possible through the use of electric automobiles.

A stable taking power from a large central station would, if of average size, add a load which, if properly distributed, as it easily could be, might become a considerable factor in straightening out the load curve of the station. If several stables were supplied from the same central station, this load would become a great source of economy to the station, and power could be sold to them at a very low figure. Owing to the regular nature of the work imposed upon the wagons in delivery service, it could easily be arranged to have the electric vehicles charged at night after the heavy load is off the station. They

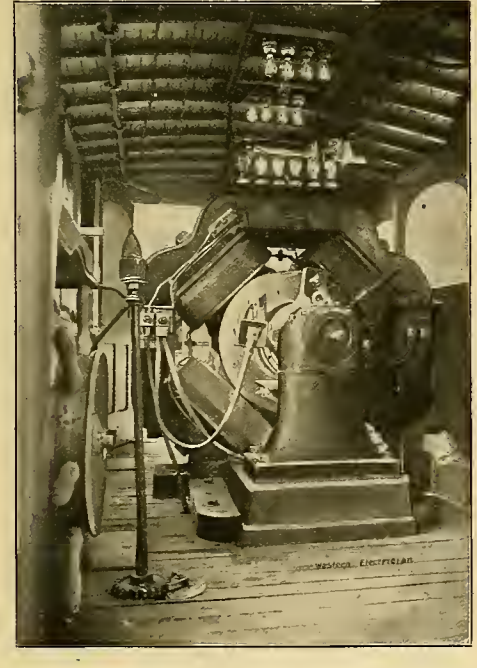


FIG. 3. ELECTRIC RAIL WELDING IN BUFFALO.—INTERIOR OF ROTARY CONVERTER CAR.

might also charge early in the morning and at noon, or at periods that experience would indicate were the most advantageous for the station, the time of deliveries being adjusted to suit the new conditions. In this way a stable should be able to buy power at from one to two cents per kilowatt-hour. As this time has not yet arrived, we will install for our purposes a small isolated gas-engine plant. A plant of this kind should be able to produce a kilowatt-hour, at the switchboard, for three cents. Assume the cost for a kilowatt-hour as three cents, the power consumed per ton-mile as 120 watt-hours and the weight as 3,500 pounds for the wagon. Taking the average load as 500 pounds, weight of driver as 150 pounds, and that of boy as 125, the total weight is 4,275 pounds. The cost for the electric vehicle to cover 11,268 miles is given in the following table:

1. Cost of power for 11,268 miles at 3 cents. A k. w. hour and a consumption of 120 watt-hours per ton-mile, total weight=4,275 lbs.=2.137 tons, watt-hours per car mile=256.44, k. w. hours per 11,268 miles=2,889.57, taking efficiency of battery at 80 per cent k. w. hours to be paid for=3,621.	$ 108.35
2. Interest on cost of wagon at 6 per cent for year. Cost of wagon, $2,300.	78.05
3. Interest on stable rent for one wagon, for year.	34.28
4. Driver	625.68
5. Boy	416.83
Total cost per year	$1,263.15

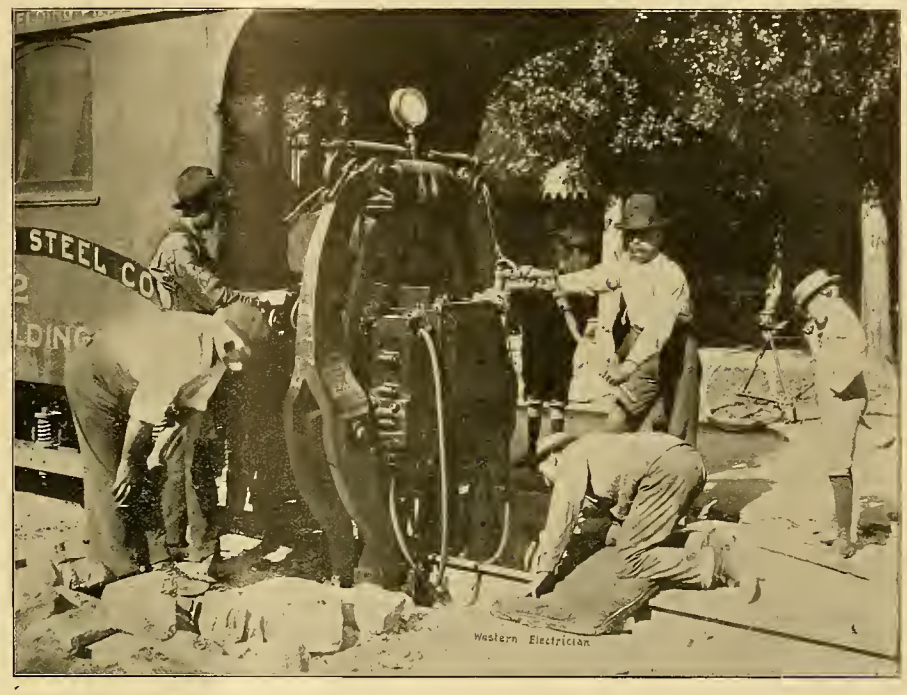


FIG. 2. ELECTRIC RAIL WELDING IN BUFFALO.—THE WELDER AT WORK.

Then the

Cost per car-mile	11.21 c.
Cost per ton-mile	5.246c.
Cost of power per mile	.961c.
Cost of power per ton-mile	.45 c.

Hence the saving, considering that the horse-drawn wagon does 36 miles a day six days a week, is 2.65 cents per car-mile in favor of the electric vehicle, which means a saving of 95.4 cents per day per wagon.

Owing to the greater speed of the electric vehicle, it takes only four hours to travel 36 miles as against 5.14 hours for the horse. This is a saving of 1.14 hours per day or of 356 hours a year.

The figures given above speak for themselves and would appear to be a most effective argument in favor of adopting the electric automobile for delivery service.

In light-delivery service in large cities, when a number of units are employed by individual firms, the adoption of the automobile would seem to be merely a question of time. For this kind of service it seems pre-eminently the best solution. It is cheaper to operate than horse service, and the mechanical problems have been so far solved as to make the vehicles commercially successful. Though, as stated before, it is not the intention to discuss depreciation, it may be noted that the comparison of the costs of operation as regards food, cost of power, etc., would show a saving in favor of the electric delivery wagon, in one year, of 20 per cent., which, under more favorable conditions as to the price of power, might easily be increased. Assuming for the moment that the depreciation in a year is 25 per cent. for the electric system, and, under the same service conditions, is only 10 per cent. for horse traction, we still have a saving of five per cent. in favor of the automobile. The advantages that will arise from the substitution of mechanical propulsion for horse traction on a large scale are so well known and understood that any extended consideration of the subject seems unnecessary. Among the many advantages, however, the following would seem to be the most important:

1. The hygienic condition of large cities will be improved and the cost of street cleaning will be decreased.

2. The wear and tear on pavements and streets will be reduced and the use of rubber tires will lessen the noise in the crowded streets.

3. The traffic in cities will not be as congested, owing to the saving in room now occupied by the horse. When we consider that there are approximately 200,000 horses used in New York city alone, and that a horse increases the length of a unit by nine feet, it can be readily appreciated how great a saving will be effected. Taking the average width occupied by a horse and shafts as two feet, it is seen that 200,000 horses occupy about 3,600,000 square feet, or 82.6 acres of valuable street room.

4. When the use of automobiles has become more general, the cost of operation will be reduced. This is true for the reason that with an increased output of wagons the price will decrease, and with the greater use of power the cost of it for this purpose will diminish.

5. The danger of accident from runaways will be eliminated.

Value of Technical Knowledge.

A writer in the Mechanic Arts Magazine of Scranton, dilating on the practical usefulness of an enlarged intelligence, advances a number of reasons why the acquisition of general technical knowledge is of value to the average man. He asks, "Why Read This Magazine?" and as his answers to the question may be applied to all technical journals of standing, some of them are quoted:

"Because it will make you more intelligent; because your intelligence, with the power that it gives you of perceiving the laws by which matter in its various forms is controlled, is one of the faculties that separate you from the lower animal creation; because you owe it to yourself to develop your natural gifts; because it is unworthy of a human being to degenerate into a mere machine, performing his part of the world's work automatically, and using the product of other men's brains without taking the trouble to understand the how and why of the results produced by ingenuity and skill.

"Learning, says the proverb, is light to carry about. Knowledge of the principles applied in the construction of the common necessaries of every-day life enlarges the mind, quickens the imagination, awakens the perceptions and opens the way to new interests which are practically unlimited.

"Or consider the matter from the standpoint of usefulness. Every fresh piece of information that you possess about useful things adds something to the capital with which you are to make your way in life. Capital does not consist of dollars and cents alone, but includes your health, your brain, your clever fingers, your ready tongue, your kindly, generous heart, which prompts you to help another over a hard place. Every newly acquired fact can and should strengthen your equipment in some one or other of these departments: and the applications of your knowledge of facts are only limited by your opportunities and your own readiness to grasp them. No one knows as well as a mechanic or a business man how unexpectedly opportunities arise."

* * *

"Every detail of your surroundings is interesting if you only knew something about it. You possibly flatter yourself that you live in an enlightened age. 'Tis quite true that you do; a great deal is known to-day about the sun and the moon and the stars that was not known a thousand years ago; a thousand years ago they didn't make as much use of electricity as they do now; no one had ever dreamed of dynamite guns and torpedoes; gunpowder had not been invented; bicycles were unknown, so were automobiles and even pneumatic-tired buggies; and neither telephones nor phonographs, nor kinetoscopes, nor amateur photography had appeared on the face of the earth. But how much do you know about these things? It's all very well to live in an enlightened age, but don't you think it would be as well if you understood some of the things that go to make the age so very enlightened?"

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition to Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

New York State Electrical Contractors' association, Buffalo, N. Y., August 29th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

Like many people in the United States, some British observers are alarmed at the growth of the trusts in this country; but the fear of the transatlantic commentators is that the great consolidations, particularly in the iron and steel industries, will make production and prices cheaper. The Iron and Coal Trades Review of London views with concern this possibility and asks if British manufacturers are preparing themselves for it. It believes that they are at last realizing the fact that they have to face a state of siege.

Evidently the president of the board of commissioners in charge of Central Park, New York, is a very cautious man. He says that he isn't opposed to automobiles, but that the new vehicles should be admitted to the park very carefully and gradually, so that, by degrees, horses can become convinced that an automobile is not an infernal machine. Of course, it is excellent to be conservative in administering the people's pleasure grounds; but isn't it one of the recommendations of the horseless vehicle that its use will render runaways reminiscences of the past? And is it not a fact that the self-propelled vehicles—that is, the electrical ones, which are practically the only ones that will invade Central Park—have actually frightened horses in remarkably few instances? Undoubtedly it will be better, as in Chicago, to allow unlimited use of the machines everywhere, provided the operators are competent and experienced.

It is certainly a great pity that there should be so much uncertainty about the prospects of an electrical exhibition in Chicago this fall. The time and opportunity are ripe for a popular electrical display in this great city, but the men to undertake the work seem to be lacking. The National Exposition of Electrical Arts company essayed the task, and the Western Electrician, believing it capable and responsible, gave it its assistance. An exposition to last from September 25th to October 9th has been announced all over the country, but it appears that the company, either internally disrupted or frightened at the preliminary expense, is about to abandon the project. But the idea should be carried out, if not by the original company, by someone else. It is not yet too late, and we hope that the valuable opportunity afforded by the Chicago fall festivities, at a time of business revival and confidence, will not be allowed to pass without a creditable electrical exhibition.

One is not apt to think of Poland as a land of industrial alertness, but an English paper states the application of electricity as a motive power is becoming general in that country. Electrically transmitted power is being adopted not only for traction, but in a great many factories where electric motors are superseding rope and belt driving. Electric lighting of factories is becoming common, all new works being built with an electric plant, while old factories are abolishing oil or gas lamps, replacing them by arc and incandescent electric lamps. On the Warsaw and Vienna railroad all important stations are being lighted by electricity, and it has been decided to increase the plants soon. In the workshops of this company only electric motors are used. The Ivangorod-Dombrova Railway company is also lighting all its stations by electricity. According to a local British consul, the Germans have succeeded in getting the lion's share of the business of supplying electrical apparatus, nearly all the important companies having representatives in Warsaw.

To transmit articulate speech over long distances without connecting wires is an undertaking beset with great difficulty, as many zealous experimenters have discovered within the last year. Yet the daily newspapers have announced, on more than one occasion, that the feat has been accomplished, basing their statements on the predictions of enthusiastic inventors, who are still, however, unable to "deliver the goods." The latest utterance of this character comes from the London correspondent of a New York daily, who has discovered that there is now resident in London a Russian doctor named Peter Steins, who asserts that he has discovered a perfect system of wireless long-distance telephony. "His experiments are being watched with great interest," adds the journalist. We should think that they would be. But it would be interesting to know more of Dr. Steins and of those who are watching his experiments. His name and fame seem to have escaped scientific observation thus far. But when he talks from London to Paris through space it will be different.

Statistics collected by John Stanton of the American Copper Producers' association show that during the first half of 1899 the output was 124,487 gross tons, as compared with 120,487 tons during the first half of 1898, and with 235,000 gross tons for the whole year 1898. Lately the production has been running at the rate of 22,000 tons a month, which would be equal to about 132,000 tons for the second half. The Iron Age, after carefully surveying the field, concludes that no very important additions to the copper supply need be expected during the current year, although there will be some expansion, unless some accident cuts off some large producer. During the first half of 1900 the preparations for an enlarged output will begin to tell heavily, it thinks, and the year ought to end with an unprecedented production of copper. To what extent, in the meantime, the present high prices for copper will check consumption, it is difficult to gauge. Apparently there is no hope of cheap copper for several months, perhaps for a year, and the prices of electrical apparatus will be likewise affected.

To err is human, and although engineers and engineering journals have the highest regard for accuracy they are still human, and they sometimes make mistakes. When such a slip occurs in the mere writing of an article, it usually deserves the mantle of charity, but when the error sticks out in a recital of the blunders of some other unfortunate, it is not unfair to remark it as contributing its mite to the gayety of nations. That is why we advert to a recent review in an American technical contemporary of a late dictionary of electrical engineering and chemistry in German, English and Spanish. The work reviewed is a German product and seems to consist of language-equivalents, arranged alphabetically in parallel columns. Some of these are funny, and in exploiting the words of this class which were alleged to be English the reviewer came across the term "booster." This excited his wonderment. "This last," he writes, "we at first thought might be a car starter, but looking across the parallel columns we find its synonyms to be 'el dinamo suplementaria' (sic) or a 'zusadzdynamo'—from which we conclude it to be the exciter attachment." O rash and impotent conclusion! In launching his shaft of ridicule the critic is himself undone. If he had had recourse to an electrical dictionary in plain English he would have discovered that "booster" is a word in good standing among electrical men and that it signifies neither a car starter nor an exciter.

Philadelphia proposes to raise money to erect a statue of Benjamin Franklin in Paris, and last week Mayor Ashbridge appointed a committee of 27 citizens to carry out the idea. When the Franklin statue recently presented to the city of Philadelphia by Justus C. Strawbridge was unveiled Mr. Beck, the United States district attorney, who delivered the oration, suggested that the citizens of the United States ought to present to the French people a statue of the great man in return for Bartholdi's statue of Liberty, given to this country. The suggestion was received with enthusiasm, and it is proposed to raise the money and begin work as soon as possible, so that the statue may be shipped to Paris in time to unveil it during the exposition of next year. It is intended to locate the statue at Passy, where Franklin lived when he was United States minister to France. Passy, then a suburb, is now in the heart of Paris. The statue will be a replica of the one in Philadelphia, which cost $14,000.

Dr. Franklin was one of the greatest of Americans, and a statue of him in Paris, where he was appreciated as a philosopher, a scientist and a diplomat, will be very appropriate, especially so as coming from Philadelphia, where he lived for 60 years and died. Mirabeau, who announced the death of Franklin in the General Assembly of France, said that "Antiquity would have raised altars to this mighty genius." Surely a modest statue, erected near the place of utterance of these words and 110 years after the time of their delivery, will in no way exceed the tribute of respect which is paid to Franklin's memory by the American and French peoples.

Daniel T. Hunt.

The successor of Charles T. Yerkes as president of the North Chicago City Railway company and the West Chicago Street Railroad company and of the companies controlled by the two companies named, is Mr. Daniel T. Hunt. As is very generally known, the North and West Side companies have recently passed under the control of a new corporation, called the Chicago Union Traction company, of which Mr. Jesse Spalding is president. When Mr. Yerkes resigned from the presidency of the old companies the honor of continuing the organizations in order to complete the details of the transfer from a legal point of view fell to Mr. Hunt as president, Mr. L. E. Owsley as treasurer and Mr. F. E. Smith as secretary. The actual administration of the roads will be in the hands of the Chicago Union Traction company, of course. The exact status of affairs, as stated by the new president to a newspaper inquirer, is as follows:

"My position is not one of extreme responsibility, as it was given me merely to meet the legal exigencies of the situation. When Mr. Yerkes stepped out and down from the presidency of the companies that were sold to the Union Traction company, some one had to be placed in his position in order that there need be no hitch in the formal transfer of stock. While I consider the honor no slight one, it should not be understood that I am to do any of the directing of the company's affairs. Mr. Spalding is at the head of the Union Traction company, and if I have any move to make it will be along the lines as agreed

DANIEL T. HUNT.

upon by the traction company's executive head and the board of directors. I cannot say just how long I will hold this position. It may take several months to complete the deal from the legal standpoint, and until it is completed I shall remain in the office."

Mr. Hunt is the worthy recipient of a very high compliment. Born in Rutland, Jefferson County, N. Y., something like 55 years ago, he has had an active and honorable career in mercantile affairs, not unmixed with the more exciting contests of politics. In his youth he displayed the activity and energy which have characterized his undertakings ever since. His first business engagement was at Charlotte, the port of Rochester, N. Y., where he was employed in the freight and ticket office of the New York Central Railroad company. He was also the local telegrapher, American Express agent and steamboat shipping agent.

For 30 years Mr. Hunt resided in Rochester, and he became one of the best-known men in that city. He was for years a member of the firm of Kenyon & Hunt, wholesale hatters and furriers. For a long time Mr. Hunt was prominent in Republican politics in Monroe County, exerting a widely recognized influence. He was appointed postmaster of Rochester by General Grant in 1876, and served under Presidents Hayes, Garfield and Arthur and far into Cleveland's first term—12 years in all, probably an unprecedented record in a city the size of Rochester. Mr. Hunt was a staunch partisan, but he conducted the postoffice on business principles, and it was regarded as one of the most efficient in the country.

In 1882 Mr. Hunt became business manager of the Post-Express of Rochester. In the newspaper business he displayed the same ability and enterprise that he has shown in other directions, and he retained the position until 1893, when he removed to Chicago to become the manager of the American Surety company of New York, of which company Mr. Jesse Spalding is the resident vice-president.

Mr. Hunt is married and has two daughters—Mrs. A. S. Clarke of Rochester and Mrs. A. P. Whitlock of Syracuse, N. Y. His office is in the Marquette building and he lives at the Hotel del Prado.

The Stanley Company.

In a reminiscent interview Mr. William Stanley recently stated that the Stanley Electric Manufacturing company, organized in 1890 at his suggestion, was doing a business of $500,000 or $600,000 a year.

"The company held to its original idea," said Mr. Stanley, "making first-class machinery better than the other fellow, and asking more for it than he did. This plan has been rigidly adhered to. The Stanley Electric Manufacturing company never attempted to compete with the cheaper, low-grade companies. It never attempted to secure a contract by offering a low price. No one man is responsible for the success of the Stanley Electric Manufacturing company. The facts are that our men simply built well-designed machines, and managed the affairs of the company well. The engineering work was in charge of Mr. Chesney and Mr. Kelly, and the managing and financial department was in charge of Mr. Gamwell and Mr. Hine. It is pleasant to think that the Stanley Electric Manufacturing company never copied the work of any other company or inventor. Every article which it has made has been constructed from original designs that have been worked out and perfected in Pittsfield.

"The future of the electrical business is of such great magnitude that it is difficult to appreciate it. It will probably be of far greater extent than the combined steam and hydraulic manufacturing work, and it is quite possible that in the next few years it will develop in one or two lines that will make the business of to-day appear as insignificant as the original undertakings appeared 10 years ago."

Mica Trust Said to Be Formed.

It is stated that a combination of mica workers has been made under the name of the American Mica company of New Jersey, with a capital of $3,500,000. The new concern will commence operation on September 1st, with head office probably in New York. It is said that the American Mica company of Boston, Eugene Munsell & Co. of New York and the Sills Mica company of Chicago are in the consolidation. Other mica manufacturers in the United States are A. O. Schoonmaker of New York, the Chicago Mica company, the Palermo Mica company of New York, the Shannock (R. I.) Mica company and the St. Louis Mica company. It is reported that an advance of five per cent. in price will be made on September 1st and that other advances may follow. The reason given for the combination is that the supply of mica is limited and that the companies have had to bid high to get the material and sell low to gain advantage over competitors.

BOOK TABLE.

DIAGRAMS AND HANDBOOK FOR TELEGRAPH ENGINEERS. By Willis H. Jones. Diagrams by W. A. Van Orden. New York: John B. Taltavall. 1899. Pocket edition. Price, $1.

The book is, strictly speaking, a collection of diagrams, and is exclusively an expert telegrapher's book. The communication of information is entirely by diagrammatic illustration. Not one word of explanation accompanies the drawings. Its field of usefulness would, no doubt, be greatly increased if some description were given, so that students and those who are not experts might be able to understand the diagrams and the principles involved. An aggregation of diagrams of the various systems of telegraphy, embracing the simple Morse system, duplex, quadruplex, polar duplex, repeaters, etc., is given. In its present form the book is a handy reminder for the use of those thoroughly familiar with the systems and apparatus illustrated. B.

Is Atmospheric Pressure Due to Electrical Action?

In an article on "Meteorologic Waves" in the latest annual report of the United States Weather Bureau, Professor H. A. Hazen makes this observation: "It would appear a good working hypothesis that our waves of high and low pressure are in the nature of fields of positive and negative electricity in the atmosphere. Our electrometers indicate positive electricity in a high, and negative in a low, or when rain is falling. Lord Kelvin has also advanced the view that electric fields may cause a disturbance of equilibrium in the atmosphere fully equal to that produced in our highs and lows. The evidence is accumulating that we have to deal here with some form of electric action. It would certainly seem a wise plan to obtain an idea of electric conditions in our highs and lows on mountains and in balloons, or, possibly, by kites."

Electrical Dealers' Meetings.

Electrical contractors from all over New York state met in Rochester, on July 21st, at the convention of the New York State Electrical Contractors' association. The meeting was held for the purpose of effecting a permanent union among the electrical contractors of the state and uniting them for mutual business and social advantage. The delegates were cordially entertained by the Rochester electrical men and after the business session a banquet was served, Mr. Fitzgerald acting as toastmaster. The election of officers resulted as follows: President, Rudolph Schmidt, Rochester; vice-president, David Cronin, Syracuse; secretary, Wells Dygert, Buffalo; treasurer, J. C. Stearns, Buffalo; finance committee, M. Jervis Myers, H. J. Sackett and M. J. Almstead. The association adjourned until August 29th, when it will meet in Buffalo. The attendance at the convention was gratifying, firms from all over the state being represented. The firms represented included:

Rochester—R. Schmidt & Co., Loeffler & Sykes, T. W. Atkinson, Higgins, Almstead company, Standard Electric Construction company, J. A. O'Brien, Elwood Electric company, Fred Fish & Co., Rochester Electric Motor company and E. C. Bradley & Co.

Syracuse—Chadwick & Lester, David Cronin, Electric Supply company, Rogers & Hilton, Charles H. Thompson, M. E. Walshe & Sons and Noxon C. Perlee.

Buffalo—T. P. Little, Electric Supply company, Buffalo Electric company, J. C. Stearns & Co., Robertson, French Electric company, Albert Mann, T. P. Jones, Mashruter Electric company, J. Loewer & Co., H. L. Peters, T. Flack & Son, Jaynes Electric company, Wilhelm Telephone company, Genesee Electric company, H. J. Sackett and McCarthy Bros. & Ford.

Other firms represented at the convention were the G. & E. company of Binghamton; J. F. Burns, Schenectady; Hyer Sheehan Electric Motor company, Newburg; Sheehan & Newett, Newburg; Still & Pritchard, Hamilton; Johnson & Morton, Utica, and the Utica Electric Supply company.

A conference of representatives of electrical supply companies was held at Philadelphia on July 20th, for the purpose of discussing the adoption of a uniform standard of prices of electrical supplies and the matter of credits.

Co-operation in Grand Rapids and Centralia, Wis.

The people of Grand Rapids and Centralia have had experience in overcoming the competition of the Bell company, which may be of value to other independent exchanges. A committee was appointed by the Business Men's associations of Grand Rapids and Centralia, Wausau, Merrill and Stevens Point, to consider the advisability of organizing independent exchanges along the Wisconsin Valley. The rates charged by the Wisconsin (Bell) Telephone company were $4 a month for business telephones at that time.

After giving the matter thorough consideration, it was decided that the only competition that would be successful against the monopoly would be one organized on a strictly co-operative basis. It was reasoned that the telephone business should be made as nearly public as possible. The result has been that the cities of Wausau, Centralia, Grand Rapids and Marshfield have all organized under the plan of purely co-operative companies, and all have made a success of the venture. The Twin City Electric company of Grand Rapids and Centralia has built an exchange worth $10,000 and paid for it in the last three years. At the time the company was organized the Bell company had 54 telephones in use in the cities of Grand Rapids and Centralia; it has now less than a dozen paying telephones, and its business is practically confined to long-distance operations. The Twin City company has 220 telephones now in use, which demonstrates forcibly what can be done by co-operation when people take the matter rightly in their own hands.

The people are now building an electric-light and power plant on the same co-operative plan, and have already money paid in, or assured, for the building of a $25,000 plant. Copies of the co-operative plan of organization will be sent to any community that would like to investigate the plan of working. E. P. Arpin of Grand Rapids, Wis., is secretary of the Twin City Electric company.

New Canadian Niagara Power Arrangement Abrogated.

A dispatch from Niagara Falls states that the Niagara Falls Power company has relinquished all its rights on the Canadian side of the river. The company has evidently refused the new agreement that the Ontario government offered to it, and which it was thought would be accepted. The new agreement deprived the company of a monopoly of the right to generate power, which was the essential feature of the old agreement, to which exception was taken in the Legislature.

Chicago Electrical Exposition in Doubt.

The National Exposition of Electrical Arts company, which has been arranging for an electrical exposition, to be held in Chicago this fall, is in difficulties, and the plans for the exhibition are in doubt. However, there is some hope that other capitalists may take up the scheme, and it is possible that visitors to the fall festivities may still benefit by an electrical show.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Cedar Valley Telephone company is about to install a 50-drop switchboard at Cedar Falls, Ia.

A mutual telephone system is being planned for Diagonal, Ia.

The American Telephone and Telegraph company has promised Des Moines, Ia., connection with the Twin Cities next year. The line will be built from Davenport to St. Paul, and from Council Bluffs to Kansas City also. The company complains that its assessment through the state of Iowa of $50 a mile is too high.

The Dakota Central Telephone company has absorbed the lines of the Midland Telephone company, extending from Ellendale, N. D., to Kulm, Ludden, Oakes, La Moure, Edgeley, Frederick, S. D., and other points.

The Retail Druggists' association of Minneapolis has again said "No" to the voice of the tempter in the shape of the Northwestern Telephone Exchange company. The latter is very anxious that druggists should agree in a body to put in nickel-in-the-slot telephones, and has made repeated propositions. But the druggists are shy and coy. They fear their customers would take offense if they had to give up five cents every time they wanted to telephone to the grocer, and they might lose trade. So they laid the proposition on the table until such time as the Mississippi Valley Telephone company (now installing an exchange) is ready to make a proposition on the matter.

The Mutual Telephone company of Des Moines, Ia., is to be sued for damages by the estate of John I. McDonald, who was killed by coming in contact with a live wire. The electric company whose wire crossed the telephone wire will also be made a party defendant.

The Troy and Honey Creek Telephone company has completed a line from Spring Green to Prairie du Sac, Wis.

W. H. Barker contemplates establishing a telephone exchange at Sanborn, Ia.

F. E. Albright and associates have been granted a franchise for a telephone exchange at Carthage, S. D.

The Spring Grove Telephone company has been organized at Spring Grove, Minn., to install a telephone exchange. The company will start with a membership of at least 25.

F. J. Thrum has bought the telephone exchange at Eagle River, Wis.

The Standard Telephone company will soon begin work on its new exchange in Dubuque, Ia.

The Northwestern Telephone Exchange company may put in an exchange at Park River, N. D.

The application of the Iowa and Nebraska Telephone company at Storm Lake, Ia., was defeated.

The Northwestern Telephone Exchange company has been refused permission in St. Paul to erect poles and string wires for its long-distance service until the corporation attorney decides the rights of the company.

The new telephone company at Fosston, Minn., will put in an automatic system.

A Chicago promoter is working up interest in favor of an independent telephone system at Menominee, Mich.

The Central Wisconsin Telephone company has been granted a franchise at Montello, Wis.

The Brodhead Telephone company has secured a franchise for a local exchange at Brodhead, Wis.

It has been reported that the Chicago and Superior Telephone company, in Wisconsin, has been planning to sell its system and franchises to the Wisconsin Telephone company, but the officers of the former deny the report.

The Southwestern Minnesota Telephone company is negotiating with the Northwestern Telephone Exchange company, and may connect its toll lines with those of the former.

The People's Telephone company of Superior, Wis., which had been depending on the Wisconsin Valley Telephone company for toll-line connection in Northern Wisconsin, announces that it will build a line of its own between Superior and Ashland, since the Wisconsin Valley has sold out to the Bell interests.

The Electric Telephone company announces free service between Germania, Algona, Titonka and Sexton, Ia.

A. T. Presson of Hudson, Wis., is an applicant at Iowa City, Ia., for a telephone franchise. He proposes to put in a local exchange.

The Wisconsin Telephone company will expend $15,000 in improvements to its system at Ashland, Wis., and vicinity.

The Home Telephone company of New Prague, Minn., and the Union Hill Telephone company of Montgomery, Minn., have consolidated. The Home company recently declared a dividend of 17 per cent.

The Minnesota Central Telephone company held its annual meeting in Minneapolis recently. The company is extending its lines all through the western portion of the state, and has had to double the capacity of its old lines.

The extension of the electric line from Stockton, Cal., to San Jose will be commenced next fall.

R. H. Evans, President People's Telephone Company.

Among the first to grasp the situation at the expiration of the fundamental Bell patents and to champion the cause of the independent telephone men in consequence was Robert H. Evans of Detroit, Mich. Mr. Evans, who is a native of Canada, for a time was successfully occupied in placing orders for different commercial houses throughout the border states. His daily intercourse with the commercial world and his experience with the varied and expensive modes of communication in vogue convinced him that the independent telephone system was a matter of moment to the general public. He associated himself with the Detroit Telephone company, and when the formation of the New State Telephone company was consummated he demonstrated his ability as a promoter by establishing the New system in some 13 different commercial centers in the state of Michigan. From these points now radiate many local lines, affording suburban and rural districts efficient and economical communication. He also disposed of some $75,000 worth of stock for these companies.

Well persuaded of the superiority of the new and less expensive system, Mr. Evans endeavored to engage the attention of capitalists in the province of Ontario, Canada, and was instrumental in obtaining a charter from the Ontario Legislature to establish and operate an improved system in the city of Windsor, and also a franchise from the City Council of London. These efforts failed of success, but Mr. Evans, nothing daunted, directed his attention to Duluth, Minn., and Superior, Wis.

The proposition of a better telephone system at cheaper rates was laid before the respective civic

ROBERT H. EVANS.

corporations of Duluth and Superior by Mr. Evans, and after the project had been fully discussed, bids were called for and a deposit of $2,500 demanded. Mr. Evans subscribed to the demand and tendered a proposal, which was accepted, and charters were granted by unanimous votes of the representatives of each corporation.

Mr. Evans has not only been successful in securing these two charters, but he was also instrumental in interesting the attention of men of capital and ability in the enterprise. The project has the enthusiastic support of the citizens of both cities and the financial backing of substantial business men. The personnel of the two concerns—Zenith City Telephone company of Duluth and People's Telephone company of West Superior, Wis.—lends semblance of no fictitious value to the undertakings. Among those interested in the corporations, beside Mr. Evans, are President J. B. Stafford of Chicago, Vice-president E. H. Stafford of Muskegon, Mich.; A. M. Miller and William Harrison of Duluth, Minn., and H. J. Minhinnick of Muskegon, Mich.

Bell Company's Statement.

The American Bell Telephone company's monthly statement of the output of instruments for the month ended July 20th, with comparisons, is as follows:

	July, 1899.	July, 1898.	July, 1897.	July, 1896.
Gross output	48,873	21,551	15,859	12,584
Returned	18,028	10,011	7,241	10,490
Net output	30,845	11,540	8,618	2,094
December 21st to July 20th:				
Gross output	389,899	187,884	127,778	126,678
Returned	109,765	83,306	51,847	53,667
Net output	280,134	104,578	75,931	73,011
Total out (July 20th)	1,405,020	1,023,699	848,558	747,987

PERSONAL.

President Hudson of the American Bell Telephone company will spend the month of August abroad.

Telephone Repeaters.

Mr. A. W. Reppy of Nashville, although not an electrician, takes much interest in electrical problems and has devoted considerable thought and experiment to the construction of a telephone repeater. He thinks that he is on the right track, but is careful to make no rash predictions. Instead, he is conducting his experiments quietly, with the hope that the successful results he has already obtained for short distances will be borne out by later tests approximating commercial conditions. Mr. Reppy began his experiments some time before Charles J. Glidden's offer of $1,000,000 for a practical telephone repeater was made. He says that the fundamental principle of his plan is very simple, and he has a qualified hope that it will result in tangible improvement to telephone service.

Mr. H. Raison of Huddersfield, England, also has an apparatus for a telephone repeater that is "certainly hopeful for practical work." He writes to the London Electrician: "Qualitatively I have not obtained the same amount in the repeater as in the first circuit, and this appears a condition in the [Glidden] offer, or I should be tempted to claim the award. Musical sounds, whistling and singing have repeated very well, while speech has been uncertain and weak. It would be interesting to know what others have done in this way, and if it has been tried on a practical line. It is a magnifier for sound that we require; the rest is easy."

Telephone Situation in Elizabeth.

The Elizabeth (N. J.) Telephone company is waging an energetic campaign. At the recent annual meeting it was reported that the company had 360 subscribers, and the number is increasing. The gross receipts for the last year were $8,472.56; expenses, $5,705.91, and the net earnings, $2,766.65. The officers were re-elected as follows: President and treasurer, William H. Rankin; vice-president, Peter Egenoll; secretary, James McMaster.

The New York and New Jersey Telephone company wants to put its wires underground in Elizabeth and lay conduits for them. The Elizabeth Telephone company opposes this, and thinks it would give the rival company a monopoly of the streets. It contends that the work of laying conduits is too expensive for it to undertake at this time, and declares that the object of the application is to crush opposition to the powerful New York and New Jersey corporation.

Home Company Victorious in Rochester.

Justice Dunwell of the Supreme Court of New York state has decided that the Common Council of Rochester acted within its powers in entering into a contract with the Home Telephone company of Rochester, granting it permission to place its poles and wires in the streets. This action was strictly within the discretion of the council, and its action is not subject to review by the courts in the absence of fraud or corruption. The action was brought by John A. Barhite, a well-known lawyer, against the Home Telephone company. It was a taxpayer's suit to restrain the Common Council and others from consummating a contract with the Home Telephone company. The court holds that the granting of the franchise was entirely within the discretion of the Common Council.

Good Management Rewarded in Grand Rapids.

The annual meeting of the Citizens' (Independent) Telephone company of Grand Rapids, Mich., was held last month at the headquarters on Campau street. The report of the year's work was read by President Rood and was very satisfactory to the stockholders, a two per cent. cash dividend having been paid quarterly during the year, the same as was done the year preceding. The report showed a net growth of 520 subscribers. The number of city subscribers was stated to be 2,859, with 649 outside subscribers, making a total of 3,508. At the stockholders' meeting, which was held during the first part of the evening, the same officers and directors elected last year were re-elected, and at the directors' meeting which followed all the members of the executive committee of last year were also re-elected.

Good Progress in Boston.

The president of the Massachusetts Telephone and Telegraph company (Independent) of Boston says that subscribers are being secured very rapidly. In Boston the lists are close to the 5,000 mark, and the company expects to have 8,000 when the system is in operation. Last week the company started to canvass for subscribers in Lawrence and Waltham. In four days it secured 40 subscribers in Lawrence and 31 in Waltham.

John Enoch of St. Charles, Mo., will ask for telephone franchise, acting for the Kinlock Telephone company of St. Louis, for which he is St. Charles manager.

Lively Times in Baltimore.

[From the New York Tribune.]

Baltimore, July 27.—At no time in the recent outbreak of trouble between the telephone companies and property owners of Baltimore over the arbitrary erection of poles has the situation been as serious as at present. Bloodshed is likely to occur at any moment. In making improvements the telephone people have found it necessary to destroy private property, erect poles in front of handsome residences, tear up valuable pavements, etc. To-day workmen employed in placing a pole in South Baltimore deliberately lowered a pole on the head of a citizen who had crouched in the post hole for the purpose of retarding operations.

The trouble grew this morning into a riot, which the police quelled by arresting three workmen. In all parts of the city the situation is the same. The police cut a pitiful figure through it all. They are supposed to preserve the peace, but their utmost effort, except in extreme cases, such as that in South Baltimore, consists in looking placidly on and enjoying the rough-and-tumble exhibitions between the corporation and individuals. They would promptly arrest any persons engaging in fisticuffs on the public streets, but there seems to be no way to check the more extensive disturbances which gather hundreds of persons to block the streets.

Two blocks on Huntingdon avenue are practically barricaded. One block on West North avenue, a fashionable part of the city, is in the same condition. Residents in this region have determined to defeat the telephone company's employes and have engaged gangs of men to tear down poles as fast as they are erected. Amid the wildest excitement and in the presence of a crowd of over 500 people, the David E. Evans company, which is erecting the poles for the Maryland Telephone company, was defeated in a combat between its men and the residents of South Baltimore in erecting a pole on the property of Mrs. Margaret E. Herget, on Warren avenue, after a protracted struggle, which lasted from two o'clock this morning until nearly noon. As the result, Mrs. Josiah Armiger, daughter of Mrs. Herget, is ill from the excitement and noise, and Mrs. Russ and a Miss Marchbanks, living in adjoining houses, are also under doctor's care for nervous prostration.

One-minute Toll-line Schedule in Michigan.

[From the Detroit correspondent of the Western Electrician.]

A new one-minute scale, at a low rate, has been announced by the Michigan Telephone company, from the Detroit office. The experiment will be tried on the Detroit-Kalamazoo line and gradually will be extended to the whole state. Ten new copper-metallic circuits have been strung from Detroit west, giving ample facilities. The cities included are Detroit, Jackson, Albion, Kalamazoo, Battle Creek, Marshall and Ypsilanti. Other points will be rapidly included, the company at present employing several hundred men on construction work. Northern Michigan points will be reached this fall.

The charges will be on a one-minute basis. Heretofore the company's charges were on a five-minute basis.

"It has been demonstrated," said Manager Trowbridge, when asked to explain the radical departure, "that 150 words can be transmitted in a minute. In adopting the one-minute basis we have figured that our new rate will place the telephone within easy access of many business men who heretofore have handled their business in other ways, on account of the expense of five-minute tolls. We will be able to give a satisfactory service. In California, where the Sunset company has a one-minute service in force, over 60 per cent. of all business is transacted within the first minute. We shall make an effort to get our subscribers to do all their talking within one minute, so to get the full benefit of the low rate. The rate from Detroit to Jackson, 78 miles, will be 15 cents per minute."

Sale of the Muncie Plant Explained.

In an interview in Boston, Mr. Z. S. Holbrook, president of the Massachusetts Telephone and Telegraph company, who was also holder of a majority of the stock of the Muncie Telephone company, recently sold to persons interested in the independent telephone company at South Bend, says:

"The report from Cincinnati with regard to the Muncie Telephone company that it cost $45,000 to build and was sold for $30,000 is misleading. The Muncie plant was an independent plant, and has been established for about two years. It did not cost $45,000, nor was it sold for $30,000; on the contrary, the plant sold for more than its cost.

"The plant has been a profitable one, although the rates were only 25 cents a week for residences and 50 cents a week for business. The plant, however, was one known as the 'common-return' and a pole system, and poles can be purchased cheaply in the state of Indiana. The officers of the company might have sold the plant for a larger figure in another direction, but preferred to have it remain within the control of independent interests.

"My interests in the company would not have been sold except for my removal to the East in the interest of the Massachusetts Telephone and Telegraph company."

NEW COMPANIES.

The Dover Telephone company has arisen to compete with the Bell in Princeton, Ill. The new company promises, if it can secure 100 subscribers, to give a combined residence and business service for $20 a year.

A franchise has been granted for a short-line telephone from Van Buren to Marion, Ind., for the special benefit of the citizens of Van Buren. The necessary poles have been shipped and the work of putting them up will be begun at once.

Columbus, O., men have incorporated the National Telephone company, to operate telephone lines in neighboring towns. The capital stock is $10,000, and the incorporators are P. H. Bruck, W. J. Dusenbury, J. J. Dun, G. W. Dun and L. P. Stephens.

The Western Independent Long-distance Telephone company of Plattsmouth, Neb., has filed articles of incorporation with the secretary of state. The capital is $100,000 and the incorporators are Charles C. Parmele, Thomas E. Parmele, Thomas H. Pollock and Thomas H. Ewing. The company will build full copper-metallic circuits, its object being to connect the principal cities and towns in Nebraska, Iowa and Missouri.

The Plattsmouth Telephone company, which has been doing business as a company since January 1, 1899, having started with 100 telephones and now having 300 and over 100 miles of toll lines, has been incorporated, with a capital of $50,000. The incorporators are Charles C. Parmele, Thomas E. Parmele and T. H. Pollock. The new company will do a general telephone and telegraph business in Cass County, Neb., with headquarters at Plattsmouth, Neb.

B. W. Bagwell, W. R. Davis and Dr. S. H. Brown of Spring Place, Murray County, Ga., about 40 miles southeast of Chattanooga, Tenn., have filed a petition for a charter for the Murray Telephone company, term of incorporation to be for 30 years and capital stock $10,000. The object of the proposed corporation is to construct a telephone line leading from Spring Place, Ga., to Fashion, Ga., via Fort Mountain and the residence of Dr. Brown, as well as to other points in the country.

The Lexington Telephone company, just incorporated, has elected these officers: President, Desha Breckinridge; secretary and treasurer, John T. Shelby; general manager, J. J. Downing; directors, W. C. P. Breckinridge, John R. Allen, F. A. Bullock, John T. Shelby, J. J. Downing and Desha Breckinridge. Active operations will be begun at once. It is probable that the East Tennessee company will enter a protest against the city's granting the new company a franchise, and perhaps will go to law about it.

Application has been made to the governor of Pennsylvania by Howard Mutchler, E. W. Evans, James Young, S. S. Yohe and G. F. Coffin, all of Easton, Pa., for the charter of a corporation to be called the United States Long-distance Telephone company, the object and purpose of which is the erecting, constructing, maintaining, purchasing, leasing and operating telephone and telegraph lines and exchanges in and through the counties of Northampton, Berks, Bradford, Carbon, Bucks, Chester, Columbia, Dauphin, Delaware, Lackawanna, Lancaster, Lehigh, Lebanon, Luzerne, Lycoming, Montgomery, Monroe, Montour, Northumberland, Philadelphia, Pike, Schuylkill, Sullivan, Susquehanna, Wyoming, Tioga and Wayne.

Affairs of the Western Telephone Construction Company.

Everyone connected with the telephone business has known of the unfortunate dissensions among the stockholders of the Western Telephone Construction company of Chicago, which is the pioneer in the independent field and one of the largest and most active concerns in the business. Mr. Madison B. Kennedy, a prominent stockholder and a man of wealth and influence, became greatly dissatisfied with the administration of President James E. Keelyn, and about a year ago he filed a bill in court, alleging mismanagement and asking for the appointment of a receiver. The company was and is doing a large business, and there appeared to be no other cause for the proposed receivership than the dissensions referred to. This seems to have been the view taken by Judge Brentano, at any rate, for on Saturday last he denied the motion for the appointment of a receiver, leaving Mr. Keelyn and his friends in possession of the field. It is to be hoped that the company will have no further trouble and will be able to attend to its business quietly.

It is claimed as remarkable that during the last six years, in every lawsuit thus far decided in which the company was one of the principals, complainant or defendant, it has been successful. This statement means that the company has contested 100 lawsuits during the period named and has not yet lost a case. The independent telephone public will doubtless be disposed to congratulate the Western Telephone Construction company upon its victory in this case, particularly in view of its importance in the welfare and stability of the business.

EXTENSIONS AND IMPROVEMENTS

A long-distance office will soon be installed at Rossland, B. C., by the Columbia Telephone and Telegraph company.

S. Hinchcliffe of the Sunset Telephone company is in Arizona, arranging for exchanges in Kingman, Flagstaff, Tucson, Prescott and Phœnix.

The Missouri River Telephone company of Atchison, Kan., has franchises for Nevada, Mo., and Pittsburg, Kan. In the latter town an exchange will be established at once.

The long-distance line of the East Tennessee Telephone company from Knoxville to Bristol is finished beyond Greeneville, with offices there and at Russellville, Whitesburg, Rogersville Junction, Mohawk, Mosheim, Midway and Rader's.

The lines of the American Telegraph and Telephone company will reach Savannah about September 1st. The lines from Lynchburg, Va., to that city are now near Olar, S. C. The company is also building from Augusta to Charleston, the lines crossing at Denmark.

The construction of the lines of the Indiana County Telephone company has now been completed to Nineveh and Cramer, Pa., and reports from those places are to the effect that the system is in the best of working order. It is the intention of the Johnstown company to connect with the Indiana County system within the next few weeks.

The Grand Rapids (Mich.) Herald says that the Citizens' Telephone company is disposing of its treasury stock, with which to defray the expenses of the improvements recently decided upon, at the rate of between $1,000 and $3,000 a day. The officers, without being elated, are very pleased over the reception which is being given the stock by investors.

The Chester County (Pa.) Telephone company has completed all its plans for extension of its lines from Westchester, Pa., and work is to be commenced at once on the improvement. The line to Phœnixville is to run by way of Malvern and take in the latter place, where it is expected a number of telephones will be placed in position within a short time, many residents desiring the service. The line to Coatesville will be via Downingtown.

It is announced that the Pittsburg and Allegheny Telephone company will have its system in operation by the beginning of 1900. Work on the system is progressing rapidly on every part of the route which it is proposed to cover and the end is in sight. The contractors who are laying the conduits have a number of the streets of the downtown district torn up now putting in the wires. A large force of men is employed and the work is not permitted to lag for any reason.

The independent telephone enterprise in Wayne County, N. Y., has made considerable advance during the last spring. The company at Lyons, organized by S. E. and A. B. Bishop of Clyde, N. Y., and united with their exchange in Clyde, has over 70 subscribers in Lyons and has completed toll lines to Newark, Alloway and Lock Berlin, in addition to the lines running to Rose and North Rose. Lock Berlin has had no telephone connection heretofore. The exchanges mentioned are connected with the Newark exchange of over 100 subscribers. Lines to Wolcott and Savannah will soon be built.

TELEPHONY ABROAD.

Contract has been made for the construction of different telephone lines in Mucatah, Mexico, at a cost of $200,000.

For the contemplated telephone connection between Berlin and Paris it is proposed to employ copper wire of five millimeters diameter. Two lines are to be constructed, one a direct line from Berlin to Paris, and the other by way of Frankfort, so that a complete breakdown of the service between the two capitals will be a remote contingency.

Removal of American Bell Company Reported.

It is stated that the American Bell Telephone company has completed its arrangements for the transfer of its entire main-office business from Boston to New York city at an early date by a consolidation with the American Telephone and Telegraph company. The stock of the latter company will be listed upon the New York Stock Exchange. The offices of the company in Boston will be occupied by the New England company, which needs more room for its increasing business.

The stockholders of the Citizens' Telephone company at Muskegon, Mich., held their annual meeting recently and elected the following-named directors: C. T. Hills, C. H. Hills, Thomas Munroe, J. G. Emery, Willam Robinson, L. B. Smith and Thomas Hume. This was followed by a directors' meeting, and the election of the following-named officers: President, C. T. Hills; vice-president, Thomas Hume; secretary, C. H. Hills; treasurer, L. B. Smith. The regular semi-annual dividend was declared.

New Westinghouse Integrating Wattmeters.

New types of integrating wattmeters have recently been produced by the Westinghouse Electric and Manufacturing company. These wattmeters are of the induction type, designed for alternating-current circuits. The design is very simple and the instruments are said to be extremely accurate over a range extending from two per cent. of the full load to 50 per cent. overload. Severe tests have demonstrated the intrinsic merits of these new types of wattmeters.

The case of the Westinghouse wattmeter is of original design, the finish being black japan; the edges, lettering and raised parts are in polished nickel. The complete case consists of two cast-metal parts, with the joints sealed, making the wattmeter dust, bug and moisture-proof, thereby excluding from the wattmeter mechanism three of the most important causes of inaccurate registration of integrating wattmeters. The meter and the terminals are sealed separately, enabling connection to the circuit to be made without any possibility of injuring the wattmeter parts.

Fig. 1. Regulating Disk.

Accuracy and permanency of calibration, as well as mechanical excellence, are made the prime factors in the manufacture of these wattmeters. The greatest care is taken in their calibration, and in order that the operation of these instruments may be guaranteed, each wattmeter is sealed and shipped in a separate box. When received, they are ready for immediate installation, without calibration or adjustment.

The extreme simplicity and compact form of these wattmeters are the striking features. They require no electrical connections to the moving parts and there are no brushes or moving contacts of any kind. This extreme simplicity of mechanism insures reliability of operation. The use of commutators and brushes to convey even the smallest amount of current to the moving parts is a distinct and well-recognized disadvantage. The moving element in the single-phase wattmeter is a single aluminum disk (Fig. 1), which is supported by a very stiff shaft, the whole being rigid and very light in weight. Great attention has been paid to this important feature, since it has a potent influence upon the performance, portability and life of the wattmeter. The illustration shows clearly the simplicity of the revolving element. In the single-phase wattmeter this entire revolving element weighs only 15 grams—about one-half ounce—being so light that there is no chance of scratching or injuring the sapphire jewel by vibration or sudden jars. This desirable feature renders it unnecessary to resort to artificial, complicated and delicate devices to obviate injury to jewels necessarily resulting from the use of heavy revolving elements. It also allows the meter to respond immediately to sudden change or fluctuation of the load. Another important feature which has direct bearing on the wear and consequent life of the meter is that the moving element makes but 50 revolutions a minute at full load.

It is affirmed that these wattmeters register accurately the true energy of the current into which they are connected, under all conditions of non-inductive or inductive load, the registration being in international watts. The law of operation of the meter practically insures absolute accuracy in registration throughout its entire range, which extends from two per cent. of full load to 50 per cent. overload. This extremely wide range is obtained by the intrinsic qualities of the meter in maintaining a strictly proportional registration for all loads. The accuracy on light loads is especially important, and is an extremely desirable feature, which should not be overlooked. In almost all stations a large percentage of the total output is used to supply small loads, which are usually but a small fraction of the full-load capacity of the wattmeter installed. The Westinghouse wattmeters possess a great overload capacity and give accurate registration of this overload; they make it practicable to install a wattmeter whose capacity corresponds to the average instead of the maximum load of the installation.

These wattmeters can be depended upon, the Westinghouse company says, to commence recording when the load is one-half of one per cent. of their full-load capacity. As an example, an installation having 240 100-volt, 16 candle power lamps connected would need a current of 120 amperes to supply all the lamps. The average load, however, would probably not exceed one-half the number of lamps installed. If the full number of lamps in the installation is seldom burning, and then only for a short time, an 80-ampere, 100-volt Westinghouse wattmeter will be the size of wattmeter to install, as it can safely carry 120 amperes and give accurate registration. The light load which would be carried for the greater part of the 24 hours would be only a few lamps, possibly not over four 16 candle power lamps (two amperes). The 80-ampere Westinghouse wattmeter, it is claimed, will give proper registration of this current, as it can be depended upon to give accurate account of two per cent. of its full-load capacity, which is three 16 candle power lamps. In other words, this 80-ampere Westinghouse wattmeter will give correct registration when but one per cent. of the total number of lamps installed is burning.

Fig. 2. Single-phase Instrument.

NEW WESTINGHOUSE INTEGRATING WATTMETERS

The loss of energy in the wattmeter has received great attention. The shunt and series windings and the mechanical features of the meter have been especially studied to bring about an arrangement of windings and methods of adjustment to minimize these losses. The shunt windings are so well proportioned, it is said, that the loss amounts to only 1.25 true watts, or, in other words, the shunts of 40 of these meters will consume the same energy as one 16 candle power lamp. In the series coil the loss at full load is so slight that it can be detected only with the most delicate instruments. This feature of the Westinghouse wattmeter is of great value, as the losses due to series coils of meters are liable to be overlooked in station practice, but are, nevertheless, of considerable importance. In some cases, in series coils containing many turns of wire, the loss is said to be from 10 to 15 watts when the meter is fully loaded. Besides using up energy in the wattmeter itself, this causes a bad voltage drop in the circuit into which it is connected. It should be borne in mind that the series coil losses are greatest when the load on the station is at the maximum. The light weight of the rotating element in these wattmeters and the great care exercised in the construction of the recording movement, or counter, practically eliminate any losses from friction in the wattmeters.

Fig. 2 shows a Westinghouse single-phase integrating wattmeter. Its counter reads directly in watt-hours, no constant or multiplier being necessary. A great variety of styles is manufactured to cover circuits of different alternations, current and voltage. With meters for large currents and voltages less than 300 volts series transformers are used; for voltages above 500, shunt and series transformers are supplied for all wattmeters.

Fig. 3 shows the Westinghouse integrating wattmeter for three-wire, single-phase circuits. The wattmeter itself is identical with the two-wire, single-phase wattmeter described above, and is made to register the energy delivered by a three-wire circuit through the medium of a specially designed series transformer, having two primary coils and one secondary coil. One of these primary coils is connected in series with one of the outside wires of the three-wire circuit; the other primary coil is connected in series with the other outside wire of the three-wire circuit; the secondary coil, in which the current is proportional to the sum of the currents in the two primary coils, is connected to the wattmeter. The shunt circuit of the meter is connected between the neutral and one of the outside wires. The counter records directly in watt-hours the total energy supplied to both sides of the three-wire installation, no multiplier or constant being necessary.

The Westinghouse integrating wattmeter for polyphase circuits records on a single dial the total energy delivered in all the phases of a two-phase or a three-phase circuit. The manufacturers say that it will make a correct registration of the true energy delivered by the circuit into which it is connected under any condition of power factor, whether the circuits are balanced or not. This is an important advantage, said to be possessed by no other wattmeter now in operation. The polyphase wattmeter possesses all the advantages and characteristics of the single-phase type, and is exceedingly small and compact, its over-all dimensions being 12 by 7½ by 6½ inches. The counter records the total energy supplied in all the phases of the polyphase circuit in which the wattmeter is connected, no multiplier or constant being necessary.

The Westinghouse Electric and Manufacturing company claims that this line of integrating wattmeters possesses many new and novel features and that it cannot be surpassed for accuracy, permanency, compactness, durability, completeness, simplicity and perfection in both electrical and mechanical design.

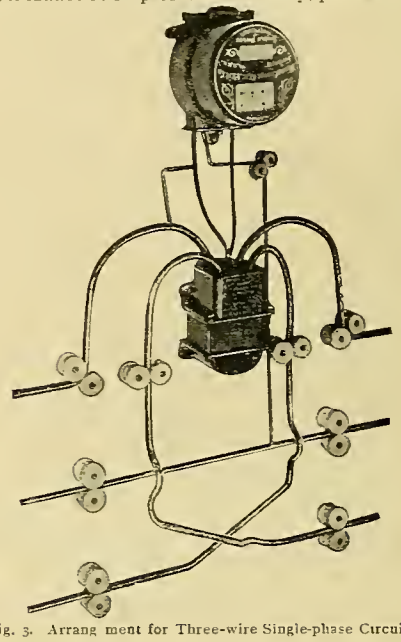


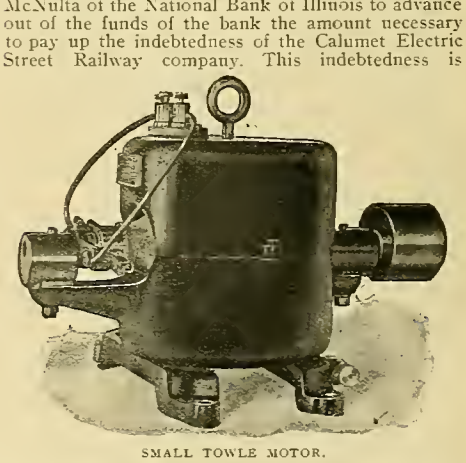
Fig. 3. Arrangement for Three-wire Single-phase Circuit.

Small Towle Motors.

The Central Electric company of Chicago has a complete line of one-twelfth, one-eighth, one-fourth, one-half and one horse power motors for power purposes. These are of the Towle type, as shown herewith, and are compact, free-running and efficient. The Central company requests inspection of these small motors or correspondence with out-of-town dealers or central-station men.

Calumet Street Railway.

Judge Kohlsaat of the United States Circuit Court entered an order last week authorizing Receiver John McNulta of the National Bank of Illinois to advance out of the funds of the bank the amount necessary to pay up the indebtedness of the Calumet Electric Street Railway company. This indebtedness is placed at $368,200, exclusive of the claims for $3,682,300 in favor of the insolvent national bank. In the petition filed in court it was stated that the receiver of the bank holds 2,944 of the 3,000 bonds, of the value of $1,000 each, issued by the road, as well as 4,838 of the 5,000 shares of capital stock, valued at $100 each. Mr. McNulta also holds receiver's certificates of the road under order of June 1, 1897, valued at $200,000, exclusive of interest and notes amounting to $54,500. Another order of the court allows the receiver to take up all the receiver's certificates heretofore issued. Both orders were entered on the recommendation of the comptroller of the currency. The receiver declared the Calumet is in a prosperous condition and that there has been an increase of almost 50 per cent. in receipts during the last six months.

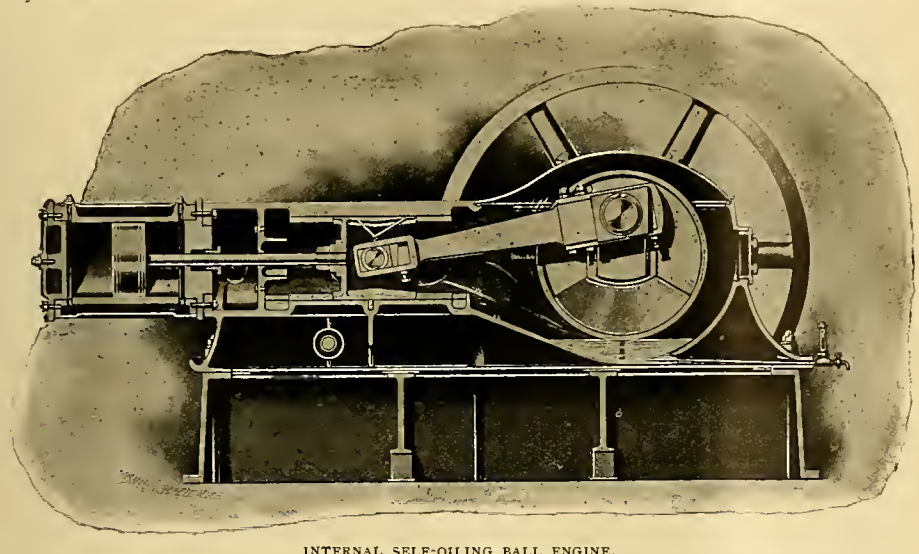


SMALL TOWLE MOTOR.

Internal Self-oiling Ball Engine.

The Ball Engine company of Erie, Pa., thinks that in its new internal self-oiling engine it has an automatic steam engine which has more points of real excellence than any other in the field, and is, withal, strongly built and pleasing in appearance. The distinctive feature of this new design is the automatic oiling system, which is simple, effective and economical in the use of oil.

It will be seen by the illustration that the oil is contained in a pocket in the bottom of the frame. The crank disks in revolving carry over a portion of this oil into a trough in the top of the frame, covered in by the hood. From thence the oil flows in



INTERNAL SELF-OILING BALL ENGINE.

streams into the main bearings, and is also carried by the radial holes to the crank pin. There are removable guiding plates, one on each side of the connecting rod at the ends of the guides next to the crank disks, so arranged that they make a slot through which the oil is guided directly into the cross-head, which has a large bell-shaped opening to receive it. The lower guides are so designed that the cross-head "floats" on the oil, and as the slides have large areas the wear is practically eliminated in these parts. As the guiding plates guide the oil directly into the cross-head, the doors on the side of the frame may be taken away for the purpose of taking indicator cards or for examination of the cross-head, without the oil being thrown on the engineer or on the floor.

These advantages are claimed: The oiling is automatic and positive, commencing when the engine starts and stopping when it is shut down, and requires no attention. There is uniform and copious lubrication of the various wearing parts, the passages being large and direct. There are no oil cups or tubes of any kind to clog up or become inoperative. The oil is not exposed to the open air or to contamination with foreign substances, as the oiling is entirely internal. There is no saponification or aeration, and the oil is kept cool and clean. There is no throwing of oil on surrounding objects.

The workmanship and materials used in the construction of this engine are of high grade. All parts are made to standard gauge and interchangeable. All moving parts are carefully balanced and the engine operates quietly and without vibration. Although the picture shows a direct-connected simple center-crank engine, the company is prepared to furnish self-oiling engines, built either as simple, tandem-compound, or cross-compound, and either side-crank or center-crank, as desired.

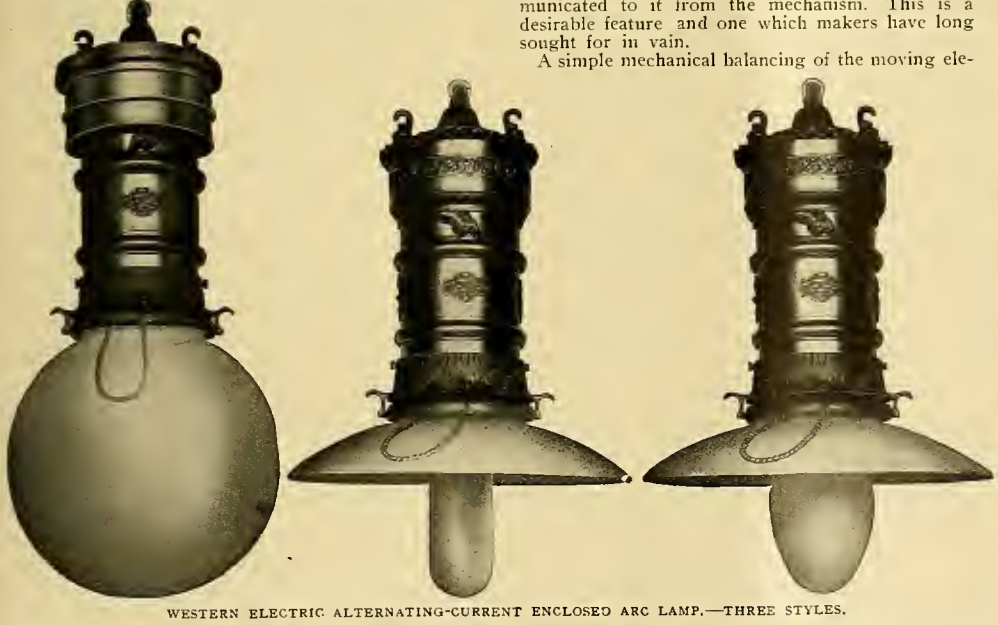
Western Electric Alternating-current Enclosed Arc Lamp.

The Petite alternating-current enclosed arc lamp manufactured by the Western Electric company, illustrated herewith, is in many respects a radical departure from former practice in this field, and it is considered to embody the most advanced ideas, both mechanically and electrically. It is put forth as strictly up to date in all features entering into the make-up of an economical and reliable lamp.

In the regulating mechanism an induction armature of aluminum is used, so combined with the laminated core of the electromagnet that great range of adjustment is secured, and it is said that the lamp will continue to burn steadily under changes in voltage which will seriously affect other forms of lamp on the market.

The carbon is fed directly by a specially designed clutching mechanism which, while giving a precision of feeding that is all that can be desired, will not allow the carbon to slip through when jarred nor by reason of the mechanical vibrations communicated to it from the mechanism. This is a desirable feature and one which makers have long sought for in vain.

A simple mechanical balancing of the moving elements in the lamp mechanism reduces the electrical energy necessary to effect regulation to a minimum, with a resulting high efficiency in the lamp.



WESTERN ELECTRIC ALTERNATING-CURRENT ENCLOSED ARC LAMP.—THREE STYLES.

A particularly noteworthy feature of the lamp is the arrangement of the side arms which support the lower carbon and its holder; these are so located with reference to each other and to the carbons that it is said that the flaming of the arc and irregular burning away of the tips of the carbons, so noticeable in many enclosed arc lamps, is entirely prevented.

The lamp is short, neat in appearance, easy to trim and is capable of use with various combinations of globes and shades. It is readily connected for operation in multiple at different frequencies, with simple means of adaptation for voltages varying from 100 to 120. It has a life of 100 hours with each trimming and is practically noiseless.

When used for outdoor illumination no hoods are necessary, a special weatherproof casing being provided, so constructed that the lamp can be used with a metal reflector, white enameled on the under side, to throw the light downward, or with an outer globe with or without a reflector.

The inner globe does not require cleaning except at each trimming.

Copper Production of 1898.

According to the figures of the Engineering and Mining Journal, the production of copper in the United States increased from 223,825 long tons in 1897 to 239,241 in 1898. The increase occurred chiefly in Arizona and Michigan, Montana showing a decrease, owing chiefly to the smaller output of the Anaconda mine. In 1898 the United States furnished more than half of the total copper supply of the world.

CORRESPONDENCE.

New York Notes.

New York, July 31.—The E. P. Allis company of Milwaukee has been awarded the contract for furnishing the engines for driving the generators in the new power house of the Manhattan Railway company. These engines, which will be among the largest stationary engines ever constructed, are to be eight in number and of 8,000 nominal horse power each. The power house is to be built on the East River, between Seventy-fourth and Seventy-fifth streets, and the work on it will be pushed as fast as possible.

It is rumored that steps are being taken to effect a consolidation of all the trolley roads in operation and building in the borough of Queens. The projectors of the new Cross Country railroad from Flushing to Jamaica are reported to be back of the movement. It is proposed to take in the new line now building by the New York and North Shore Railroad company and all of the roads operated by the New York and Queens County company in Long Island City and vicinity and combine them with the Long Island Electric Railroad company.

A new through express service is to be operated between the Brooklyn bridge and Manhattan Beach, by way of the Kings County Elevated, Brighton Beach and Long Island railroads. The first through train will leave Manhattan Beach at 7:30 a. m., and trains will leave half-hourly thereafter throughout the day until 12 midnight. The first through train will leave the Brooklyn Bridge station at 7:45 a. m., and thereafter every 30 minutes throughout the day until 10:45 p. m. These trains will stop only at City Hall, Franklin avenue, Clarkson street and Sheepshead Bay, the running time from the bridge through to Manhattan Beach being 40 minutes.

The libel suit which was preferred against President Rossiter of the Brooklyn Rapid Transit company by Albert L. Johnson, the former president of the Nassau company, has been formally withdrawn by Mr. Johnson's counsel.

It is said that representatives of the St. Louis and the Brill Car companies have been in consultation with officials of the Stephenson Car company, whose plant at Elizabeth, N. J., has been idle for some time, and that a consolidation of the three companies is being negotiated. A large foundry and a number of other departments may be built and the works enlarged to three times the present size of the plant. It is expected that nearly 2,000 hands will be employed in the carworks before the fall. The shops of the St. Louis and the Brill company will also be kept running.

At a recent meeting of the aldermen, a resolution was offered by Alderman Neufeld, which was referred to the law committee, to the effect that all gripmen, motormen and conductors upon the street or elevated railroads in the city shall be required to obtain licenses in the same manner as the hackmen. These licenses are to be issued only to citizens of the United States and to those who have resided in the city at least one year prior to the application for the license.

Frequent conferences have been held recently between President Rossiter of the Brooklyn Rapid Transit company and committees representing the firemen and locomotive engineers of the Brooklyn elevated road in relation to a readjustment of the rates of wages consequent on the change from steam power to electricity on the road. It is claimed that a satisfactory agreement has been reached and that there will be three grades of motormen in the elevated-road service. The first or lowest grade will include the men running the local bridge motor cars, the second those who run through electric cars over the bridge, and the third, or highest, the men who were locomotive engineers. The lowest rate of wages will be $2.25 a day. The two higher rates have not yet been definitely fixed. M. S.

Detroit, Mich.

Detroit, July 29.—The old rumor has been revived of a proposed electric-railway system across the entire state. The promoters of the enterprise are said to have headquarters at Marshall, Mich.

The Port Huron and Port Austin Electric Railway company has filed articles of incorporation. The capital is $25,000.

Thomas Forbes, formerly a trimmer employed by a Detroit firm, was arrested at the request of R. A. Tress of the Detroit Electric Light and Power com-

pany, on suspicion of stealing wire. Detroit telephone companies have been bothered for some time by an organized gang. Other arrests will follow.

Otsego, Mich., has annulled its contract with the Otsego Electric Light company and has made one with the Kalamazoo Valley company, and a merry war is on. Otsego claims that the Otsego company has not fulfilled its contract, and hence the right to annul its agreement. The Otsego company has about $10,000 invested and does not propose to lose the plant. W. H. Coats, hydraulic and electrical engineer of Grand Rapids, has made a special test of the lights in behalf of the city. His conclusions have not yet been given the public.

George W. Bullis of Ann Arbor is interested in the proposed lines between Hastings and Battle Creek. If the connecting lines are built, as contemplated, this will give a continuous line across the state from Grand Rapids to Detroit.

Don M. Dickinson, attorney for the river-front freight "L" line, writes that the promoters of the road are about to disclose their plans for a bridge, below Belle Isle, with an appropriate electric system.

Detroit's first automobile company was organized early in the week. The present capitalization is $150,000, and assurances are forthcoming that $1,000,000 will be subscribed, if deemed necessary. The concern will manufacture the Ford motor, the invention of Henry Ford, mechanical superintendent of the Edison Electric Light Works of this city. The Ford motor uses gasoline. Ford claims that there is no noise or odor from his gasoline motor. The incorporators are Colonel F. J. Hecker, W. C. McMillan, C. A. Black, A. E. F. White, S. S. Delano and Frank R. Alderman, who acts as secretary.

G.

PERSONAL.

George Henry Wheeler, president of the Chicago City Railway company from 1891 to 1898, is reported to be seriously ill at Bluff Point, N. Y.

Mr. J. E. Woodbridge, editor of the American Electrician, and Miss Ethel Hotchkiss, daughter of Mr. and Mrs. J. F. Hotchkiss, were married on July 23d, at Grace Church, New York city.

Frederick Charles Webb, a prominent English telegraph engineer, committed suicide last month while despondent from ill-health. Mr. Webb was over 70 years of age and had taken a prominent part in submarine-cable laying.

Mr. M. E. Baird, general manager of the Eddy Electric Manufacturing company of Windsor, Conn., who has been in charge of the Chicago office of the company, is spending a few weeks in the East on a combined business and pleasure trip.

Mr. J. H. Cooke, representing the western interests of the Buckeye Electric company, has been spending some time in the Northwest, visiting St. Paul, Minneapolis and other points. He reports that the outlook is bright for record-breaking sales of incandescent lamps.

The senior prize offered by the council of the British Society of Mining Students for the best paper on "Electricity as Applied to Mining Engineering," has been awarded to W. S. Gresley, mining engineer of Erie, Pa., who is an honorary member of that institute.

Professor H. S. Carhart, professor of physics and electrical engineering at the University of Michigan, is in Europe. He has a year's leave of absence from the university and will spend it in study in Germany and France. Professor George W. Patterson, who has been in Germany for a year, will return and have charge of Professor Carhart's work during his absence.

The Missouri-Edison Electric Club, composed wholly of office employes and heads of departments of the Missouri-Edison Electric company of St. Louis, recently held its annual meeting, followed by a banquet and minstrel entertainment. The following-named officers were elected: President, P. J. Parker; vice-president, F. Schwedtmann; secretary, Frank Herbert; treasurer, T. S. Clark. The old boards of directors and trustees were re-elected.

Mr. Homer E. Niesz, formerly assistant superintendent of construction for the Chicago Edison company, has been promoted to be assistant to the general superintendent of the company, Mr. L. A. Ferguson. Mr. Niesz's advancement is well deserved, as he has made a fine record for capacity and zeal. He succeeded Mr. John J. Abbott, who resigned to become assistant cashier of the American Trust and Savings Bank. Mr. Niesz's successor in the construction department is Mr. E. W. Lloyd.

ELECTRIC LIGHTING.

Electrical street decorations will be conspicuous in the Chicago fall festivities. It is proposed to erect a number of arches and stud them with incandescent lamps. Mr. Samuel Insull, president of the Chicago Edison company, is a member of the subcommittee on decorations.

Incorporation papers were recently filed at Albany, N. Y., by the Catskill Mountain Electric company, for the manufacture and production of light, heat and power in Ulster and Delaware counties. The capital stock is $100,000. The following-named gentlemen are the directors: John B. Blish, George H. Lasher, Carl Herman, all of Fleischmans, N. Y.; Charles C. Kaufman, C. S. Allaban and Andrew J. Kaufman of Margaretville; C. L. Andrus, Stamford, N. Y.

The contract for furnishing 323 electric arc lights for Binghamton, N. Y., was recently awarded by the City Council to the Binghamton General Electric company at 27 cents a night for each light.

The Syracuse Electric Light and Power company, operating in Syracuse, N. Y., is soon to have a competitor, it is said. The Underground Electric Wire company proposes to enter the electric-light field with an increased capital as soon as it can erect and equip a plant.

A Bloomington, Ill., dispatch states that a corporation known as the Bloomington Gaslight and Electric company has been formed by the consolidation of the Citizens' Gaslight and Heating company, the Citizens' Electric company and the Gridley gas works. The capital stock is $400,000. It is understood that most of the capital is furnished by Chicago men, including Morris Ullman. The deal unites all the lighting plants of Bloomington, with the exception of the Bloomington Electric company.

The South Wales Daily News states that work has already been commenced in connection with a new electrical station at Penarth, which the government has decided to erect and equip in connection with national coast defense. The buildings will cost about £4,000, and will be erected on the highest point of the cliff, about half a mile on the Penarth side of Labernoch Point. A powerful searchlight is to be a feature of the station. According to the same authority, the station and searchlight will be used by the Severn submarine miners. The station is to be utilized also for training this corps in electric-lighting work for military and naval purposes.

ELECTRIC RAILWAYS.

It is said that a large factory for the production of Short electric-motor equipments is to be built at Preston, England, and that Professor Short will superintend the erection of the works in person.

The street-car strike in Cleveland has practically resolved itself for the present into a boycott against the street-railway company and those who patronize its cars. Some additional attempts at violence were made last week, but the militia and police are preserving good order on the whole.

The Mill Creek Valley Street Railway company of Cincinnati has been enjoined by Judge Thompson from using car controllers infringing the Condict patent, No. 393,323, belonging to the General Electric company. The controllers held to be infringing were made by the Johnson company and the Steel Motor company.

Judge Adams of the United States Circuit Court for the eastern division of the Eastern District of Missouri has issued a decree enjoining the Central Union Brass company from infringing on the Van Depoele patent, No. 424,695, for "Improvements in Suspended Switches and Traveling Contacts for Electric Railways," owned by the General Electric company.

It is stated that the Metropolitan West Side Elevated Railroad company of Chicago and the Chicago, Burlington and Quincy railroad have practically come to an agreement whereby the suburban trains of the latter line will be switched on to the elevated road at its western terminus, near Douglas Park boulevard, and carried into the heart of the city and around the Union Loop.

A temporary injunction was granted the West Chicago Street Railroad company recently, preventing interference with the extension of its Kedzie and California avenue lines across the boulevards. This victory of the company over the West Park Board, which opposed the boulevard crossings, was celebrated on the evening of July 26th with fireworks and a parade along Kedzie avenue.

The Washington Traction and Electric company of Washington, D. C., has placed contracts for 10 storage-battery cars, to be run on the Anacostia and Potomac River division. These cars will be duplicates of the storage-battery cars now running in Chicago on the line of the Chicago Electric Traction company. The old trolley cars of the system will be changed to provide for the batteries, which will be furnished by the Electric Storage Battery company.

Says the Chicago Record: Everyone connected with the management of the elevated-railroad properties in Chicago is cheerful over the prospects for the future. The traffic figures each month for the last six months at least have shown steady increases over last year's records. The Metropolitan road for the first two weeks of July gave an increase fractionally under 26 per cent. The South Side Elevated has shown steady gains in traffic up to 23 per cent. last month, and it is highly probable that the stock will soon be put on a four per cent. basis. The Lake Street Elevated also reports encouraging gains in the traffic every month, with conditions favorable to greater percentages of increase.

The directors of the Consolidated Traction company of Jersey City held their annual meeting recently. The following were elected officers of the company for the ensuing year: President, Bernard M. Shanley; secretary, T. J. George, and treasurer, E. N. Hill. The new board of directors is as follows: B. M. Shanley, C. A. Griscom, R. C. Jenkinson, Jeremiah O'Rourke, Thomas F. Ryan, E. B. Gaddis, A. H. Paget, John E. McArthur, Henry Lembeck, Albert G. Jennings, L. P. Ward, William J. Davis, Bernard M. Shanley, Jr., Dudley Farrand and James J. Corbiere.

The Plainfield (N. J.) Daily Press states that the new trolley line from Staten Island ferry to the Granford township line, and ultimately to Plainfield, which is being built by Senator John Kean, will probably be called the "palace line," as the cars will be unusually handsome, being painted pure white with gold lettering. The interior of the cars will be finished in birdseye maple, with large mirrors in the end; the cushions will be of red velvet, and beside each seat will be a touch-button to signal the conductor. Each platform will have a rubber mat, while the center of the floors will be covered with the same material. The trucks of 15 of the cars have arrived, and the road probably will be in operation by the middle of August.

The Hanover Street Railway company, which recently came into existence as the result of a consolidation of the five roads about Hingham, Mass., has organized with the following-named officers: President, Albert L. Register of Philadelphia; vice-president, Hon. John J. Whipple of Brockton, Mass.; treasurer, George A. W. Dodge of New Haven, Conn.; secretary, Gardner F. Welds; other directors, Oliver E. Williams of Boston, David Peffer, Jr., of Philadelphia, Clarence Burgin of Quincy and Herbert Nash of Boston. The company contemplates a change of name from Hanover Street Railway company to South Shore and Boston Street Railway company. The property is appraised at $1,276,470, with a net floating debt of $297,000.

"On every trolley car that runs from the Astoria ferry, opposite Ninety-second street," says the New York Commercial Advertiser, "there is a poster, in flaring colors, showing the right way and the wrong way of alighting therefrom. On one side of the poster is a spruce-looking damsel in the act of stepping easily to the ground, with her face toward the motorman. At the other is a stout dame in the act of turning a somersault on the pavement, with her packages of kitchenware and baskets of vegetables flying in all directions. The lettering accompanying the pictures reads simply: 'How to Get Off and How Not to Get Off a Trolley Car.' At the first glance it looks like an advertisement, but close study shows it to be nothing but a free gift of advice on the part of the transportation company."

AUTOMOBILES.

The automobile race around France, in which great interest was taken, was won by M. De Knyff, a Belgian, who, with a 16 horse power machine, covered the distance in 44 hours 44 minutes, an average of 31 4-5 miles an hour.

A dispatch from Paris states that two automobiles on July 30th beat the Paris-St. Mole express in a race between those cities, a distance of 226 miles, making the best time ever recorded for an automobile, covering the distance in seven hours and 35 minutes. The time of the train was seven hours and 48 minutes.

The automobile has received official recognition at the hands of the German government. Five automobile postal wagons have just been ordered by the postmaster-general. Three of these are to be petroleum and two electric. If they prove satisfactory it is the intention of the authorities to abolish the horse post wagons and replace them with automobiles.

It is stated that the new bicycle trust is capitalized at $40,000,000, 42 bicycle plants having been absorbed, at a cost of $31,000,000, leaving $9,000,000 for working capital and to force out competition. Under the agreement each factory hereafter will make but one grade of wheels. According to the daily papers, it is proposed to make electric automobiles so cheaply that the gasoline vehicles will be forced off the market.

The Tractor-truck Automobile company has been incorporated in Trenton, N. J., to operate automobiles for the carrying of freight, passengers and express matter, the capital stock being $2,500,000, of which $1,000,000 is to be preferred stock bearing seven per cent. non-cumulative dividends, and $1,500,000 common stock. The incorporators are T. Henry Dixon, J. Russell Taylor, C. Berkeley Taylor and George H. B. Martin.

A plan is said to be on foot to establish an automobile line between Morristown, N. J., and New York. Many wealthy residents will urge the Morris County Traction company, which has a capital of $250,000, to apply to the freeholders to grant a charter for the proposed line. The residents of the town object to a trolley line which it is proposed to construct, and in view of this objection the traction company may start an automobile line.

The Chicago Tribune says that an automobile plant to cost a trifle of $5,000,000 is being built in Long Island City. The work is already well under way, it is said, and two machine shops for the big plant are rapidly going up. The factory is being built on the property of the Daimler Manufacturing

company. It will be operated under the name of the Daimler Manufacturing company, of which it is an outgrowth, and it has the financial backing of the Whitney syndicate.

The Electric Cab company of London is having more than its share of ill-luck in operating its cab service. To meet the increasing demand the company was rushing the building of more vehicles, but it encountered a serious setback. Society people, who have become infatuated with the automobile fad, need drivers for their machines, and as they are willing to pay good wages, the trained drivers of the Electric Cab company have been induced to accept positions with the owners of private automobiles.

Some time in the fall electric automobile street-sweeping machines will be used in Paris and the old clumsy dust machines will in time be done away with. The motor is in front, while underneath and behind is a tank for water. The sprinkling device is in the rear, near the sweepers, which can be raised out of contact with the pavement whenever desired. The new machine can be run back and forth over a street to sprinkle it. It will then return and sweep the dirt in piles and electrically driven carts will carry away the dirt after it has been heaped in piles.

An interesting automobile race between electric carriages took place recently in Paris and brought out the good features of the American machines in a very gratifying manner. The race was called the criterium des electriques, and was organized by the paper Sport Universel Illustre. The course was from Porte Maillot to Poissy and back, a distance of about 50 kilometers. The Columbia carriage of G. Philippart won the race in one hour 20 minutes and 29 seconds, while M. Garcin was second in one hour 48 minutes and 10 seconds. M. Berg, in his Columbia voiturette, made the trip in one hour 53 minutes and three seconds, thus coming in first in the voiturette class. The Columbia automobiles use Phœnix accumulators, the invention of M. Philippart.

One of the largest traction engines ever built was recently completed by the O. S. Kelly company of Springfield, O., and shipped to Cuba, where it has been used with considerable success on one of the largest sugar plantations. The boilers are of the locomotive type, with grate surfaces varying from nine to 12 square feet. The boiler pressure is 180 pounds per square inch. The engine develops 120 horse power. The drive-wheels are eight feet in diameter, and the steel-plate tires are provided with cleats four inches wide and two inches thick, extending completely across the face at such an angle and distance apart as to insure the complete bedding of one cleat on each wheel before the preceding cleat has left the ground. The front wheels are five feet in diameter and are similarly constructed. Steering is effected by the usual hand-wheel, worm and shaft, fitted with chains secured to the front axle. With a grade not exceeding five per cent., the Scientific American says that a net load of 30 tons can be hauled 30 miles per day by this traction engine. Over dry, natural soil even 112 tons has been hauled. The engines are adapted to haul freight from plantations and from mines so remote from railroads that the transportation of low-grade ores becomes unprofitable.

TELEGRAPH.

Dispatches from Manila give the information that the Signal Service Corps established cable communication with Calamba on July 29th. This cable insures uninterrupted telegraphic communication with the advanced posts in the country occupied by the insurgents. It is expected that within a short time all the islands in the archipelago will be connected with Manila by cable.

The extensive pole yards of the Western Union Telegraph company have been removed from Monroe, Mich., to Delray, Mich., on the Detroit River. Monroe is on a small river, near Lake Erie, and the removal was due to the fact that the waterway from the lake to the docks was of insufficient depth. It is said that if the citizens of Monroe had bestirred themselves sufficiently to have caused the dredging of the channel the yards would not have been removed.

PUBLICATIONS.

A neat booklet, entitled "Perfection in Detail," shows the good points of the C-S push-button switches and wall boxes made by the Cutter company of Philadelphia. Prices are given.

The Western Electric company of Chicago is distributing to the trade a neat pamphlet describing its electrical novelties. Electric flashlights, walking canes, searchlights, gas-lighters and dental, bicycle, carriage and photographic lamps are among the specialties quoted.

A beautiful booklet has been issued by Westinghouse, Church, Kerr & Co., New York, on the subject of "Light and Power Installation for Private Residences and Hotels." A handsome cover, heavy, tinted paper with rough edges and a number of dainty illustrations combine to make the book very attractive. The illustrations include views of private residences and hotels where electric lighting is provided by Westinghouse gas engines and generators. The Westinghouse gas engine is specially adapted for electric lighting, and can be operated by using gasoline as fuel when gas is not available. With an electric plant, light is supplied for the house, stables and grounds, and also power for operating pumps, elevators, ventilating fans, lathes, saws, preparing fodder, ice freezers, dairy, laundry and other work connected with private residences and hotels.

MISCELLANEOUS.

Space telegraphy exhibits and experiments will be a feature of the coming National Export Exposition in Philadelphia.

It is reported from Pasadena, Cal., that Professor T. S. C. Lowe proposes to install a $10,000 electric fountain in the opera house of that city.

The new pattern works of the Westinghouse Electric and Manufacturing company, in course of erection at East Pittsburg, Pa., collapsed on July 27th, burying a number of workmen in the ruins. One man was killed outright and five others were seriously injured. A bridge company was putting up the structural iron when the accident occurred.

R. C. Richards, an operator and lineman for the Postal Telegraph company at Gallup, N. M., was killed by lightning on July 29th at McCathy's Station, about 18 miles east of Laguna. He was perched on a pole testing a wire and talking to the wire chief at Albuquerque when he was struck, the shock knocking him off the pole and killing him instantly.

Westinghouse, Church, Kerr & Co. have received a contract from the Atchison, Topeka and Santa Fe Railroad company for electrical equipment at the Fort Madison shops, Fort Madison, Ia. The firm has designed the installation, which includes lighting the shops and the railroad yards, providing electrical current for operating the turntables for locomotives and for furnishing power in the machine shops and other purposes.

The steamship Civic brought to New York 9,999 bags or 250 tons of copper coins from India, consigned to the Orford Copper company. It is said that the coins will be melted for refining purposes, as they are imported as copper scrap. It is explained that the coins are worth more as copper than as coins with the price of copper standing at or about the present value of $18.50 for Lake. The statement is made that when copper stood at 10 cents there was a profit in coining for the Indian government, but conditions are now changed by the prices ruling for copper. It is said that the copper coins of China can also be imported and melted at a profit.

For the information of intending bidders, the following data regarding the electric plant and cranes for the New York navy yard are presented: The machinery to be installed will consist of one electric generating plant, complete, from which will be transmitted power to electric motors located at various points in the several steam-engineering shops of the yard; four-motor electric traveling crane for the steam-engineering shops, maximum working capacity to be 40 net tons, the crane to have a 70-foot span and travel about 347 feet; three-motor traveling crane, of 25 tons' capacity or 35 tons at test load, with 70-foot span and travel of about 338 feet; two three-motor 10-ton cranes, to travel 347 feet; two three-motor traveling cranes, of 10 tons' capacity, to travel 338 feet. Bids will be received at the Bureau of Supplies and Accounts of the Navy Department, Washington, D. C., until August 8. 1899. Blank forms of proposals may be obtained from the bureau or at the Navy Pay Office in New York.

TRADE NEWS.

W. H. Jacob, the popular manager of the sales department of the Triumph Electric company, Cincinnati, spent a few days in Chicago last week in the interests of his company. Mr. Jacob reports that the Triumph company has more orders on hand at the present time than ever before in its history, which speaks well for the excellence of the apparatus. The company's success is due in no small measure to the energetic efforts of Mr. Jacob.

The Hays Construction company, consulting engineers, Troy, O., which makes a specialty of remodeling electric-light and street-railway plants which have run down and are not paying satisfactory dividends, is meeting with considerable success in its line. The company has remodeled and put on a paying basis a number of plants, and W. S. Hays, the chief engineer, has been particularly successful in this work. The company is anxious to communicate with companies which have obstacles of this kind to overcome, as it believes it can be of great service.

BUSINESS.

The Lynn Incandescent Lamp company of Lynn, Mass., issues a blotter stating that "Now is the time to gather up your burned-out lamps and ship them to us for renewal or exchange for new ones."

The Electric Appliance company, Chicago, has gained the enviable reputation of advertising and pushing a specialty only when it is absolutely sure that it is an article of merit. The company is now sending out handsome mailing cards describing the Noxall annunciator, which has become so popular in its territory.

Marquette, on Lake Superior, is one of the most charming summer resorts reached via the Chicago, Milwaukee and St. Paul railway. Its healthful location, beautiful scenery, good hotels and complete immunity from hay fever make a summer outing at Marquette, Mich., very attractive from the point of health, rest and comfort. Those desiring further information should apply at the ticket office, 95 Adams street, Chicago.

W. C. Sterling & Son, Monroe, Mich., one of the best established firms for the production of telephone, telegraph and electric-railway poles in the country, state that the volume of their business has exceeded all expectations. Sterling & Son have 11 pole yards in Michigan and have been wholesale producers for 20 years. The product handled by them is said to be the best put on the market. The firm is known far and wide and bears an enviable reputation.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, report numerous shipments of their well-known Helmet oil and Perfection and Bonanza oil cups throughout the agricultural districts, extending from Maine to California. In fact, the firm has never experienced so large a demand for this well-known lubricant as at the present time. Besly & Co. are also just equipping a machine shop in India with lathes, drill presses, chucks, fine tools, etc. The new 1899 catalogue is now ready for distribution and is mailed free upon application.

The Manhattan Electrical Supply company, 32 Cortlandt street, New York, one of the best-known electrical supply houses in the East, is having its hands full filling orders for its well-known products, particularly its telephones and the famous Mesco battery. The business of the Manhattan company is by no means confined to the United States, as it constantly receives orders from foreign countries. The company recently issued a handsome new catalogue (No. 10), which conains much information of value to those interested in telephone and other electrical work. This catalogue will be cheerfully mailed to anyone on request.

Bryan & Humphrey, consulting mechanical and electrical engineers, St. Louis, Mo., report a very active season. The original installation of 2,500 horse power for the Imperial central station at Tenth and St. Charles street, St. Louis, Mo., is about completed, and an addition of 1,500 horse power of engines, generators and boilers is being installed and is expected to be in service by October 1st. Bryan & Humphrey are installing an isolated electric-lighting plant and electric elevators in the Nugent dry-goods store. They have also contracted for electric elevators for the new Lindell and Boyle buildings on Washington avenue, and are lengthening the chimney of the Mercantile Club. Their out-of-town work includes a central station at El Paso, Texas, a 500 horse power boiler plant for the state lunatic asylum at St. Joseph, Mo., a 1,200-light isolated lighting plant for the state lunatic asylum at Nevada, Mo., and an electric pumping station at White Hall, Ill. They also have in hand considerable work of less importance, covering a wide field of engineering.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 25, 1899.

629,325. Secondary Battery. Ralph Ashley, Port Republic, N. J. Application filed July 29, 1897.

In a storage battery the combination with the series of cells, superimposed upon one another, forming a stack or pile, the cells at one end or side formed with a vertical channel, of the positive and negative electrodes located in the cells, and the conductors secured to the electrodes and passing up through the channels and electrically connecting the negative electrode of one cell with the positive electrode in the cell above.

629,340. Electrical Hair Brush. Albert J. Cook, Jersey City, N. J. Application filed April 11, 1899.

The brush body has a plurality of groups of metallic bristles insulated from each other, a battery, an induction coil having its primary winding in circuit with the battery, and separate circuit-wire connections between the primary and secondary windings of the induction coil and the separate groups of bristles. (See cut.)

629,363. Accumulator Plate. Heinrich F. Hobel, Berlin, Germany. Application filed January 31, 1899.

Electrode plates for accumulators, characterized by a large number of small flat formations having a triangular shape being placed alternately with their flat sides to one another in such a way that the points correspond to a similar position of the bases of the next layer, when placed side by side, and affording a latticed work or grid of large surface composed of several columns thus formed and per-

forated in an oblique direction, so that solid bars pass through from one side of the frame to the opposite one both in the latticed work and also in the active mass after it has been spread over the latticed work.

629,371. Storage Battery. Charles W. Kennedy, Rutledge, Pa. Application filed August 29, 1898.

This is an electrode for a storage battery having a series of bars or plates provided with perforations, each perforation having the surrounding metal reduced to a thin edge in or near the central transverse plane of the perforation, and pellets tightly inserted in the perforations, each pellet being formed of coils or rings of active material adapted to expand radially of the apertures.

629,372. Storage Battery. Charles W. Kennedy, Rutledge, Pa. Application filed August 29, 1898.

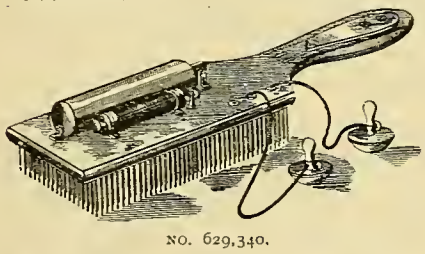
A storage battery is described having a series of several superimposed cells arranged to hold the entire electrolyte of the battery in a series of relatively shallow bodies one above another, the pair of electrodes each consisting of a series of parallel perforated sheet-lead tubes, the tubes of one electrode interlapping with the tubes of the other, all the tubes of both electrodes being in the same horizontal plane, and charged with granular active material, two horizontal connecting bars, one for the outer ends of each series of tubes, the interlapping ends of the tubes being disconnected from each other, and both the electrodes of each pair being adapted to be submerged in one of the shallow electrolytic masses between the bottom of one cell and the bottom of the one below. (See cut.)

629,373. Cover for Junction Boxes. Edwin Kern and Charles Claflin, New York, N. Y. Application filed October 12, 1898.

A junction box adapted to be set into the wall, having an opening or openings for the connection of the conduits and the entrance of the wires, a cover therefor having an opening for the passage of the wires leading to the lamps sustained on the fixture, and a fixture-supporting piece secured to the cover and insulated therefrom.

629,394. Process of Reducing Metallic Compounds and Producing Metallic Carbides. Isaiah L. Roberts, New York, N. Y. Application filed May 26, 1896. Renewed May 18, 1899.

The process of reducing metals or forming carbides thereof which consists in supporting the mixture of the finely divided metallic compound and carbon upon an incandescent conductor or conductors, passing a current of electricity through the conductor or conductors, fusing the materials, preventing the passage of the unfused mass, and allowing the fused metal or carbide to continuously pass the conductor.



NO. 629,340.

629,397. Automatic Magnetic Circuit Breaker. William M. Scott, Philadelphia, Pa. Application filed January 28, 1898.

In combination with an electric switch, means for causing the opening of the same, means independent of the switch for normally restraining the opening means and automatic magnetic means for actuating the restraining means.

629,398. Controller for Electric-motor Cars or Vehicles. Sidney H. Short, Cleveland, Ohio. Application filed March 2, 1895.

A controller for an electric car or vehicle is described which comprises a suitably actuated shaft, a series of suitably arranged contacts operatively connected with the shaft and a series of relatively stationary contacts adapted to be electrically engaged by the contacts on the shaft, of a contact located within the line of the circuit, a circuit breaker located in the line of the circuit and adapted to electrically engage the contact, the circuit breaker normally being out of engagement with the contact, means operatively connected with the shaft for actuating the circuit breaker into electrical engagement with the contact, means operatively connected with the shaft for electrically disengaging the circuit breaker from the contact preparatory to the interruption of the electrical engagement between contacts of the two series of contacts, means for locking the circuit breaker in its normal position, means operatively connected with the shaft for actuating the locking means to unlock or release the circuit breaker, and means acting to retain the locking means in its operative position.

629,399. Controlling Apparatus for Electric Motors. Sidney H. Short, Cleveland, Ohio. Application filed April 25, 1896.

In combination with a motor circuit and a controlling switch for the circuit, a series break consisting of a series of stationary contact points, a series of movable contact points, a device normally having operative engagement with a movable part of the controlling switch when the latter moves toward the "on" position, means for automatically disestablishing the engagement upon reaching the "on" position, a connection between the device and the movable contacts of the series break, and a separate device attached to the connection and having operative engagement with the movable part of the controlling switch when the latter is moved toward the "off" position, whereby the first movement of the controlling switch toward the "on" position throws the contact points of the series break into circuit and leaves them in that position during any further movement in the direction of the controlling switch, while any movement of the latter toward the "off" position at once opens the contact points.

629,406. Adjustable Hanger for Incandescent Lamps. William N. Thorp and Frank G. Normart, Fresno, Cal. Application filed August 12, 1898.

This is an incandescent lamp hanger having a rotatable reel or drum, conducting rings fixed to the reel or drum and provided with tongues to which are attached the conductors of a suspension cable, guide tubes supported on a frame in which the reel is mounted, and stems in electrical engagement with the guide tubes and with the conducting rings. (See cut.)

629,424. Arc Lamp. Edward M. Cashion, Glens Falls, N. Y. Application filed August 29, 1898.

One claim describes an arc lamp, an inner globe for surrounding the carbon points, a ventilating cap on the end of the globe, comprising two plates adjustable one relatively to the other so as to form an air space between them, the inner of the plates having an opening through which the carbon passes, the opening being larger than the diameter of the carbon, the outer plate having an opening, the wall of which engages closely against the carbon, and a dustpan on the carbon, and adjacent to the inner plate.

629,435. Third-rail Electric-railway System. John R. Farmer, St. Louis, Mo. Application filed December 22, 1897.

The combination consists of a supporting rail, a third rail supported thereon and shaped like an inverted U, insulation between the same and forming an air space between the bottom of the third rail and the supporting rail.

NO. 629,372.

629,445. Plug-receptacle for Electric Circuits. John T. Hunt, New York, N. Y. Application filed August 12, 1898.

The receptacle has a removable side and is provided with a partition and openings to admit the main conducting wires, posts and contacts within the receptacle and carried thereby, and a transverse screw entering the partition and securing the side combined with the plug adapted to enter the receptacle and provided with the contacts adapted to engage the contacts within the receptacle, conducting wires carried by the plug, and a face-plate to conceal the plug.

629,504. Motor Apparatus for Looms. Albert B. Herrick, Ridgewood, and William M. Brock, Paterson, N. J. Application filed August 23, 1898.

The combination with a driving shaft, of a motor, means for starting the motor without load to a speed sufficient to overcome the static inertia of the driving shaft, and means actuated by the motor for connecting the motor with the driving shaft, the means being actuated by the motor when the speed has been attained.

629,508. Insulated Conductor. Jasper N. Keller, Newton, Mass. Application filed September 7, 1898.

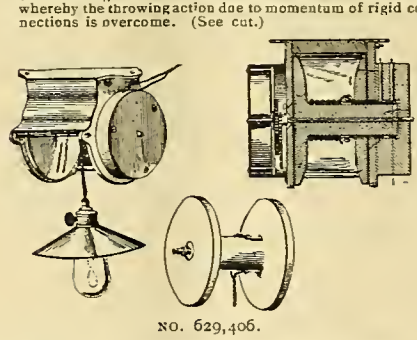
An insulated conductor, consisting of a metallic conductor and an insulating covering, interposed between which are fragments or pieces of insulating material slightly separated from each other.

629,521. Motor Vehicle. Lucius J. Phelps, New Brunswick, N. J. Application filed June 20, 1898.

One claim describes a locomotive tractor provided with an electric motor controlled by a rheostat and commutator by means of which the motor is started, regulated, stopped and reversed, the combination of a steering wheel mounted in a fork with steering head and handle bar, sheave wheels mounted at the extremities of the handle bar and a pair of reins passing around the sheave wheels and attached to the lever of the commutator.

629,580. Time Stamp. Ernst R. Malmborg, Chicago, Ill. Application filed January 20, 1899.

A time stamp is described, the combination with the time mechanism comprising an electromagnet of an armature for the magnet, a rocking arm actuated by the armature, a flexible band actuated by the rocking arm and time-indicator mechanism actuated by the flexible band, the flexible band forming a non-rigid connection between the rocking arm and the time-indicator mechanism, whereby the throwing action due to momentum of rigid connections is overcome. (See cut.)



NO. 629,406.

629,584. Station Potential Indicator. Ralph D. Mershon, New York, N. Y. Application filed February 1, 1899.

A station potential indicator for alternating-current circuits having line capacity, line leakage or distributed load or two or more of the conditions, comprising a local circuit having means for approximately reproducing in miniature the impressed and counter electromotive forces of the main circuit and each of the line conditions as may exist, and means for indicating the value of the resultant electromotive force.

629,603. Electric Arc Lamp. Paul F. H. Queisser, Charlottenberg, Germany. Application filed September 19, 1898.

An electric arc lamp is described, the combination consisting of a suitably supported carbon, of feeding mechanism therefor, a dash-pot and an adjustable device interposed between the dash-pot and feeding mechanism, having separable engagement with the dash-pot, whereby the feeding mechanism is relieved of the braking influence of the dash-pot when the arc is in its normal condition.

629,624. Electric Signal. Wendell H. Stillwell, Topeka, Kan. Application filed May 17, 1899.

A signaling device, comprising an electric circuit, a circuit-closer arranged in the circuit, means operated from a block at the side of a track rail for closing the circuit-closer, and an order-holding clip, the order-holding clip also serving as a short-circuiting device.

629,631. Electric-headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed April 6, 1899.

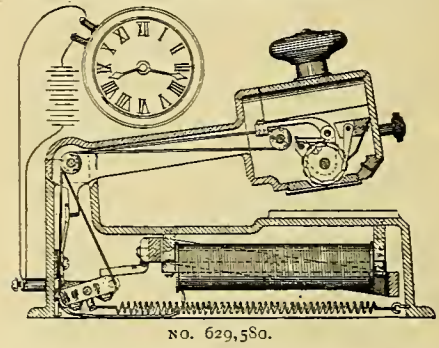
The combination with an electric-railway car having at its end a housing, and a primary coil located within and projected beyond the housing, of a headlight lamp and a secondary coil carried by the lamp and adapted to be placed in inductive relation to the primary coil when the lamp is placed in its operative position, the lamp casing having an opening therein coincident with the secondary coil.

629,638. Electric Door-opener. Adolph F. T. Wiechers, New York, N. Y. Application filed September 15, 1898.

The combination of the alarm-circuit and means for closing the same, an electrical door-opener and a circuit therefor, means, independent of the alarm circuit, for closing the circuit of the door-opener, another device for closing the circuit of the door-opener automatically when the alarm circuit is closed, and a switch for establishing or interrupting the electrical connection of the door-opener with the last-named circuit-closer of the door-opener circuit.

629,645. Telegraph Sounder. James S. Baynard, New York, N. Y. Application filed April 22, 1898.

A telegraph sounder is described, provided with an electromagnet, a spring-pressed armature lever for the same, an adjustable backstop for the armature lever, and of a different material than the electromagnet cores, for producing distinguishing sounds upon the attraction and release of the armature lever, the loudness of the sound being governed by the position of the adjustable backstop, and a resonant casing containing the electromagnet, armature lever and backstop, the adjustment of the latter permitting of contacting the backstop with the casing at the point farthest from the armature lever, to transmit the sound given by the armature lever to the backstop to the casing, for producing sound calls or signals.



NO. 629,580.

629,663. Fuse Block for Electric Circuits. Harry P. Davis, Pittsburg, Pa. Application filed March 23, 1899.

There are two separable parts, one of which is provided with circuit terminals and an opening and the other of which is provided with a fuse and fuse terminals and a projection having a blow-out passage and fitting in and extending through the opening, in combination with a clamping device adapted to engage both parts of the block and draw them together.

629,664. High-tension Circuit Breaker. Harry P. Davis, Pittsburg, and Gilbert Wright, Wilkinsburg, Pa. Application filed March 23, 1899.

An automatic electric circuit breaker, the combination with a single stationary laminated contact terminal and a single stationary carbon terminal, of a single movable terminal corresponding to each of the stationary terminals, a supporting arm for the terminals having a flexible electrical circuit connection and pivoted to a hinged support, and means for actuating the support to swing the carbon contact terminals into engagement and thereafter move the supporting arm longitudinally to bring the main terminals into engagement.

629,665. Controller for Electric Motors. Harry P. Davis, Pittsburg, and Gilbert Wright, Wilkinsburg, Pa. Application filed March 24, 1899.

A controller for electric motors, the combination with stationary contact fingers or brushes of a drum provided with suitably arranged and connected contact pieces, a shaft upon which the drum is rotatably mounted, a spring for storing the energy imparted to the shaft, means for clamping either end of the spring to the shaft and the opposite end to the drum, according to the direction in which the shaft is rotated, a device for holding the drum stationary and means for withdrawing the holding device at a predetermined point in the rotation of the shaft.

629,682. Condenser. Peter C. Hewitt, New York, N. Y. Application filed June 1, 1897.

This is an electric condenser, comprising a dielectric with coatings, each having a spiral trend, one right and the other left.

629,685. Electrolytical Production of Zinc or Other Metals. Carl Hoepfner, Berlin, Germany. Application filed July 16, 1896.

A process which consists in placing a soluble metallic anode in a solution of a salt capable of dissolving the same, placing a suitable cathode in a second solution containing a metal other than that contained in the anode solution, separating the two solutions by a suitable diaphragm, passing a current, thereby brineing the anode metal into solution and depositing the cathode metal, precipitating the anode metal from the anode solution and conveying the resulting solution to the cathode compartment.

629,686. Process of Extracting Zinc from Its Ores. Carl Hoepfner, Frankfort-on-the-Main, Germany. Application filed November 18, 1897.

The process consists in oxidizing roasting a zinciferous solphidic material, converting the resulting sulphurous acid into sulphuric acid, causing the latter to react upon a suitable chloride in the presence of heat and reacting with the hydrochloric acid gas thus formed upon the oxidized material in the presence of a metallic chloride solution, whereby a neutral or slightly basic solution containing zinc in the form of a chloride is obtained, and electrolyzing the latter solution.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, AUGUST 12, 1899. No. 7

Extensions of the Lake Street Elevated Railroad.

Within the last few months the Lake Street Elevated Railroad company of Chicago has made some important extensions and improvements which have added considerably to the value of the service. The main line, which runs west from the Union Loop on Lake street, has been extended through Austin to Wisconsin avenue in Oak Park. From West Fifty-second street, which is the dividing line between Chicago and Austin, the road follows South boulevard to Lombard avenue, thence south to Randolph street and west on Randolph to Wisconsin avenue. The residence districts of both Austin and Oak Park are thus reached and suburbanites are given rapid and efficient transportation to and from the city.

As the road passes from Chicago into Austin at Fifty-second street it changes from a third-rail elevated system to a surface railroad with overhead-trolley construction. To effect this change and allow a through-car service to Oak Park an incline was constructed, a portion of which is shown in the accompanying picture. This incline extends from the station at Fifty-second street to Willow avenue, a distance of some 1,400 feet, and is built with grades of one and two per cent. The third rail extends to within a short distance of the foot of the incline, while the trolley wire runs over the incline about half its length.

Each motor car is provided with two trolley poles, one at each end, and when not in use they are pulled down and fastened securely. The changing of the motor connections from the third-rail to the trolley wire or vice versa is accomplished by means of a large double-throw switch placed in the motor-car cab. The switch is thrown when both the contact shoe and the trolley are in contact. It is specially designed for the purpose and is so constructed that the two circuits act in parallel in operating the motors during the short interval that is consumed in changing the switch from one set of contacts to the other. The illustration shows a west-bound train, consisting of a motor car and two trail cars, descending the incline with the trolley pole in position.

Current at 550 volts for the trolley line and the incline is obtained from the Cicero and Proviso Street Railway company's station in Oak Park, while the road east of Fifty-second street is supplied at the same voltage from the Western avenue station of the West Chicago Street Railroad company.

Another extension that has been recently opened is the company's line to the Harlem race track. This branch, which is also an overhead-trolley system, leaves the main line on Randolph street at Cuyler avenue. It runs south on Cuyler avenue to Harrison street, thence west to Harlem and south into the race track. On days when there is racing at the track express trains are put on, running through to Harlem without stop from the Randolph and Fifth avenue stations in the city. These trains are run at seven-minute intervals between one and two o'clock and for a sufficient length of time to bring the people back after the races.

During the morning and evening the cars on the main line are operated on a six-minute schedule through to Oak Park, and during the rest of the day cars are run every seven minutes. A three-minute service is also maintained in the morning and evening between the city and Austin.

A fare of five cents is charged between the city and the Fifty-second street station, and between that point and Oak Park or Austin five cents additional is collected. But commutation tickets which enable passengers to travel over the whole length of the main line are issued at the rate of five cents a ride. A charge of 25 cents is made for the round trip on the express trains to Harlem.

The company operates 37 motor cars and 88 trail cars. The motor cars weigh 52,000 pounds each and carry two General Electric motors rated at 160 horse power each. The trailers weigh 32,000 pounds. All cars are equipped with the Westinghouse automatic air brakes. The speed of the trains varies between 22 and 35 miles an hour. The company is according its patrons excellent service at present and other improvements are contemplated by General Superintendent Frank Hedley. From Rockwell street west the elevated structure is arranged to accommodate three tracks and for the greater part of the distance the third track is already laid. When this track is completed, express trains will be put on, to run from Oakley avenue to Fifty-second street without stop. This service will reduce the running time between Chicago and Oak Park about 15 minutes. The running time for the round trip on the present schedule is 93 minutes.

EXTENSIONS OF THE LAKE STREET ELEVATED RAILROAD —INCLINE AT WEST FIFTY-SECOND STREET.

Electrical Trade with Russia.

[From the Washington correspondent of the Western Electrician.]

The attention of manufacturers of electrical machinery and appliances is called to the growing and important market for electrical apparatus presented by the Russian empire. During the year 1898 the shipments of electrical machinery from this country to Russia were valued at $16,810. The shipments during the current year have been somewhat larger, but there are circumstances which lead to the belief that our electrical trade with that country can be greatly increased if proper efforts are devoted to securing that market. The future of Russia unquestionably lies in industrial development, which, in its now rapid growth, creates new and increasing demands, and these demands may well be supplied by the United States. The rapid progress that Russia is making in industrial centers has attracted much attention in England, and British manufacturers and exporters are awakening to the fact that the Russian empire is a market of immense importance, and they are consequently laying their plans to secure control of that market.

It has long been the opinion of our diplomatic and consular officers in Russia that an exposition of certain specialties of American electrical manufacture in Russia would be of great interest and value, as exhibiting such progress as we have made in our development, and opening the way to larger trade relations between the two countries. The idea seems to have taken definite shape, the State Depart-

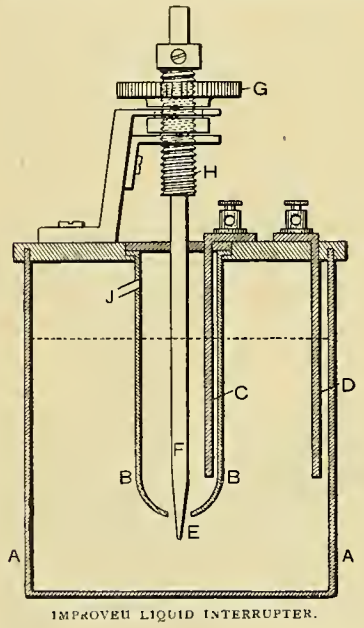
ment having laid the matter before the manufacturers of the country; it is now waiting to hear from them before taking further action in the matter. Individual manufacturers have expressed hearty appreciation of the opportunity, and Congress, at the coming session, will undoubtedly enact the legislation necessary to put the project through. The plan is to move the exhibits at the close of the Paris Exposition to either Moscow or St. Petersburg, and to carry on for five months an exposition of American manufactures. It is asserted that the cost will be as nothing to the trade advantages secured. The demands of Russia are just beginning to be felt, and the people of that country are inclined to adopt American methods rather than those of any other nation. Congress will act promptly if there is manifested by manufacturers a desire for the display of their exhibits in Russia. T.

An Improved Liquid Interrupter for Rhumkorf Coils.[1]

By A. A. Campbell Swinton.

The following is a description of an improved form of liquid interrupter, which for use with Rhumkorf coils appears to have several advantages over the interrupters of Wehnelt and Caldwell, of which it is a modification. Like the most recent Wehnelt arrangements, it is capable of easy adjustment to suit different sizes of coils, different voltages, and to take more or less current, and give discharges of different powers and frequencies. It appears, however, to be free from the troublesome phenomenon of fatigue, while it operates equally well whatever be the direction of the current.

The apparatus consists of a glass vessel (A) filled with dilute sulphuric acid, into which dips the lead



IMPROVED LIQUID INTERRUPTER.

sheet (D), which forms one electrode, and also the hollow-glass cylinder (B), which is also filled with dilute acid and contains the lead sheet (C), which forms the second electrode. The glass cylinder (B) is closed at the bottom, with the exception of a small circular aperture (E), about three or four millimeters in diameter. Through this aperture projects the small end of the conical glass valve (F) which, by means of the screwed-carrier tube (H) and milled nut (G), can be raised or lowered so as to close or open the aperture to any desired extent. As in operating the level of the liquid is found to rise rapidly in the inner cylinder, an overflow is provided at (J). Like all electrolytic interrupters, it will only operate upon an inductive circuit, the amount of the self-induction being one of the factors, while the applied voltage is another that determines the frequency.

With a given amount of self-induction and a given voltage, the extent to which the aperture is opened or restricted by means of the valve enables both the frequency and the amount of current to be varied within wide limits. The valve arrangement is, in fact, even more efficacious in this respect than the adjustable platinum wire used by Wehnelt, while the difficulties experienced with the latter, especially with alternating currents, of the wire melting and the installation becoming cracked are entirely avoided. It is true that, after prolonged use, both the valve and the edges of the aperture become slightly eroded; but if the valve be made long enough, this is easily compensated for. Both for the inner cylinder (B) and for the valve (F) porcelain may be substituted for glass.

As the direction of the current through the aperture does not affect the result, it does not signify which electrode is made positive or which negative. With alternating currents, the sparks in each direction seem to be of uniform power, and by suitable adjustment it is quite simple to obtain with alternating currents discharges of equal length and power to those obtained with continuous currents. With one of these interrupters connected in circuit with a 10-inch Rhumkorf coil direct on to the 100-volt mains (either continuous or alternating), we have found it possible by simply altering the adjustment of the valve to vary the primary current from 0 to 25 amperes, and also to obtain great variation in the frequency. The introduction into the primary circuit of additional self-induction, or of non-inductive resistance, enables the frequency to be varied still further.

In the design of this interrupter, and in carrying out the experiments, I am indebted to the co-operation of Mr. J. C. M. Stanton and Mr. H. Tyson Wolff.

1. From The Electrician.

Exhibitors at the Wilmington Convention.

The display of electrical apparatus in Wilmington, Del., from September 4th to 9th, in connection with the convention of the National Association of Municipal Electricians, promises to be a success. Following is a list of the exhibitors so far secured: Roebling's Sons company, Trenton, N. J.; Wilmington Electric Light company, Morris & Co., Pyle bicycle supplies, William Lawton, Garrett, Miller & Co., Harlan-Hollingsworth company, all of Wilmington; Bundy Lamp company, Elmira, N. Y.; F. M. Ferrin and J. S. Wilson of Boston; Universal Electric Switch company, James W. Godfrey (Habirshaw wire and cables), Manufacturers and Inventors' Electric company, Standard Underground Cable company, Okonite company, Gamewell Fire-alarm Telegraph company, Baine's Primary Battery company, Machado & Roller, Montauk Multiphase Cable company, Fred Pierce, Monarch Fire Appliance company, National India Rubber company (Henry Stanley), Safety Insulated Wire and Cable company, Day's Kerite, all of New York; C. A. Rolfe Electric company, Chicago, Ill.; Shelby Electric company, Shelby, Ohio.

Float Representing Electrical Power.

To the large number of people interested in power matters at Niagara Falls, one of the principal features of an industrial parade held in that city on Monday, July 31st, in connection with the opening of an Elks' Fair, was the float of the Niagara Falls Hydraulic Power and Manufacturing company. By its decorations this float was made emblematical of the interests it was designed to represent. It was, as shown in the picture, a large platform set on a wagon truck, suitably draped and decorated. In front stood a mast several feet high on which hung arc and incandescent lamps, while in front of the mast was an eagle. The center of the platform was filled with the products of the mills on the power company's lands, and on the platforms sat four bright-faced young girls. Underneath the platform was a tank filled with water, and running from

FLOAT REPRESENTING ELECTRICAL POWER.

it up through the mast to a water-wheel on the back of the platform was a hose, the nozzle of which was suspended over the wheel. By means of a hand pump the water in the tank was forced through the hose and fell upon the wheel, causing it to revolve, the water passing back into the tank for continued service. The lower part of the float was draped in black, and the lightning flashes painted on this suggested electricity. The float was drawn by four coal-black horses, each in charge of an attendant dressed in white duck. The illustration shows the parade passing down Main street. The line was over three miles long.

Desaymar Incandescent Lamp.

The accompanying illustration, reproduced from l'Electricien of Paris, shows a lamp named for its inventor which is to ordinary incandescent lamps what the Welsbach lamp is to an ordinary gas burner—a lamp which is claimed to give a considerably increased luminosity at a minimum cost.

A glance at the picture will show the peculiarities of this lamp, which, like all incandescent lamps, has the bulb, the vacuum and the filament through which the current courses, heating the carbon to incandescence. The carbon, in place of being sim-

DESAYMAR LAMP.

ply a loop, however, is made to coil around a vertical tube in the center of the bulb. This tube is made of a special composition, and is said to give to the lamp a much greater illuminating power, in addition to that obtained by the peculiar form of the filament, at an economy, it is claimed, of 40 to 50 per cent. of the current used.

Ordinary incandescent lamps of 16 candle power, says the French journal, consume an average of 64 watts or four watts per candle. At a price of 12 centimes per hectowatt the expense is about eight centimes per hour. Many experiments have been made which give results showing that the Desaymar lamp of 16 candle power shows a maximum cost of four to five centimes per hour. This economy in an extensive plant would be no inconsiderable item, and should be an incentive to the more rapid installation of electric plants.

An important establishment is being installed at Rueil for the manufacture of these lamps, based on the experimental tests, which have been carefully and extensively made.

Electric Railroading in Korea.

The opening of an electric railway in Seoul, the capital of Korea, on May 1st, marked an important step forward in the advancement of that nation. For nearly 4,000 years the only means of travel enjoyed by Korean gentlemen, says a correspondent of the Railway Age, have been by the use of chairs or litters carried by laborers, and a jump direct from the sedan chair to an electric railway is certainly an event in eastern life worthy of notice. The opening ceremonies were attended with much pomp and gayety, people from all over the country having traveled to Seoul expressly to witness the event.

Difficulty was experienced in operating the first car on account of the throngs of people who pressed forward on the tracks. No mishap occurred, however, and after the car which contained some of the officials of the road returned to the power house a messenger arrived from the emperor requesting that a special trip be made in order to afford him and his suite, and the crown prince and his suite, an opportunity of inspecting the cars. This was promptly complied with, and the emperor expressed his pleasure and approval of the new enterprise and its successful introduction.

The fares on the road vary, according to distance, from two to 15 cents. This, it is said, creates surprise, because the people cannot understand why it costs less to ride so rapidly in a beautiful carriage than in a sedan chair, which can only be carried by coolies.

All the details of arranging the safe opening and accompanying celebrations were under the care of Mr. H. R. Bostwick of San Francisco—a task involving much anxiety, when the fact is remembered that the Koreans knew nothing of railways or of electricity, and that in Cairo, Egypt, about 60 people were killed during the first week of the street cars in that city.

Electricity in Hat Manufacture.

A recent and very interesting application of electric heat and power is in the manufacture of hats. In hat manufacturing power is required to drive the machinery; heat is necessary in large quantities for the sizing, coloring and dry-rooms; hot tools are used for finishing, and light is required for a part of the year. The heat necessary to produce a hat in the "rough" may be obtained from steam, while for finishing either gas or slug-heated tools have been generally used. Some up-to-date hat manufacturing establishments, however, are now supplied with complete electrical equipment.

From the generators power is distributed throughout the works for running motors attached to the different machines formerly driven by shafting; electric heat is furnished to the hand shells, machine-iron shells, veluring and shackle stoves, curling machines, flanging bags, press heads and other hot tools used in finishing; the plant is lighted by electricity; while the exhaust steam from the engines is used to heat water for the sizing and coloring departments, to keep the water boiling, in the dry-rooms and for other purposes where only a low temperature is needed.

Many advantages have been found to result from the introduction of electricity. Chief among these is the economy that has resulted from installing the new system. The engines furnish all the heat and power necessary for the processes of manufacture by means of the generation of electricity and the utilization of the exhaust steam. As a rule, the only other purpose for which it has been necessary to supply live steam has been for the heating of the buildings. This economical use of steam has resulted in reducing operating expenses to a considerable extent. Other advantages claimed are that better tools can be used, by which a better grade of goods may be manufactured, and that the fire hazard is lessened by the use of electrically heated tools.

The Hadaway Electric Heating and Engineering company of New York has installed many plants and has devoted considerable attention to electric installations in hat factories. Chief among the hat-making establishments making large use of electricity are those of F. Berg & Co., Orange Valley, N. J., manufacturers of soft fur hats; the New Milford Hat company, New Milford, Conn., manufacturer of stiff fur hats, and William Carroll & Co., Matteawan, N. Y., who manufacture straw hats. The accompanying illustrations show some of the electrically heated tools made by the Hadaway company and used by the hat manufacturers named.

In the Berg factory the power plant is provided with three boilers of a rated capacity of 225 horse power each. The main engine is a 425 horse power Corliss, driving two main shafts on opposite ends of engine with flywheel grooved for rope transmission. A supplementary engine of 75 horse power is direct-connected to a 50-kilowatt dynamo. The main dynamo is of 150 kilowatts capacity and is belted from a main shaft. The water heaters are of 1,200 horse power rated capacity. The exhaust system is provided with separator, back pressure and automatic reducing valves. Electric motors are used for driving the pouncing, drying, shaving, sizing, ironing, curling and sewing machines and "whizzer." The motors have a rated capacity of 40 horse power. There are about 800 incandescent lamps of 16 candle power each and 20 enclosed arc lamps for lighting interior bays in finishing rooms. Small cluster lighting is used to a considerable extent for general illumination. All of the finishing is done by electrically heated tools, of which there are over 300. These consist largely of 15-pound hand shells, supplemented by veluring stoves, machine-iron shells, curling-machine heaters, flanging bags, etc. The switchboard is provided with switches for the various heating circuits, lights, motors, etc. All of these circuits are independent for facility of control, running to distribution boards on each floor. The exhaust is used for boiler-feed and hot-water supply for sizing and coloring, for heating the "vertical" dry-rooms by hot blast, for boiling the water in plank shop, etc. Coils are immersed in the tubs for boiling the water and the back pressure on the system is about four pounds. The balance is established so as to use all the exhaust the entire year, the factory heating being treated as an intermittent load and using live steam.

For the stiff-hat plant of the Milford company the boiler plant is rated at 250 horse power. The engine is an 18 by 36 Corliss, running at 80 revolutions per minute. The dynamo is a moderate-speed 75-kilowatt belted machine. Electric heating and lighting are used, but no motors. There are about 225 incandescent lights of 16 candle power each in this plant. The electric heaters used are veluring stoves, curling-machine shells, hand shells, rounding-off shells, tip-printing and embossing presses, etc. The switchboard carries switches for the light and heater circuits, which run to panel boards on each floor. The water heaters are of 250 and 500 horse power capacity respectively, the first being used for boiler feed-water heating, the second for water heating for sizing and coloring departments, etc. The system is run without back pressure, the water heaters condensing the exhaust. The hot-water heater is connected to a storage tank for equalizing the condensation, and so that the coloring and sizing vats may be filled rapidly with water heated to at least 205° F. The system is arranged so that the moderate-temperature dry-rooms may be heated by hot water. The storage capacity of the water is valuable for this purpose in reducing the amount of steam required at night. The hot water from condensation in water heaters and waste hot water from coloring department is collected in a large iron shell in which a long coil of heavy pipe is immersed. The waste hot water heats all the water used in the factory from 40° to 50° F. The factory heating is done by live steam, as well as the high-temperature dry-room, presses, etc. There is not an open coil in the factory, all condensation being returned to boilers through an automatic return trap. The large-capacity hot-water system is of value in the winter in reducing the amount of steam required to protect the "wet" sprinkler system.

The plant of the Carroll factory has an especial interest, as it was the first in which electric finishing appliances were used on a large scale. Matteawan is on a small river which empties into the Hudson, and power is obtained for most of the time from a 42-inch turbine operating under 29-foot head. A 150 horse power Corliss engine is in reserve for low-water periods. The dynamo is a 65-kilowatt alternating-current machine with belted exciter. The primary voltage is 1,000; transformers are

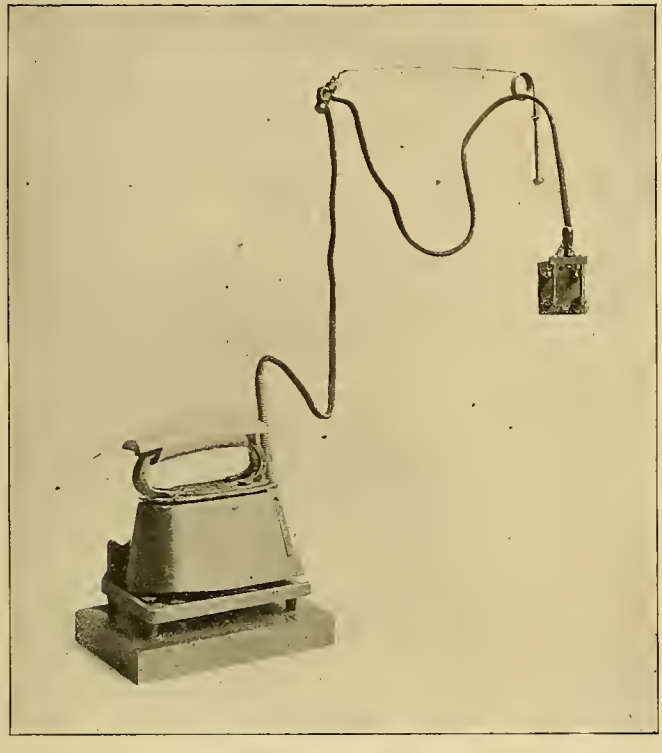


Fig. 1. Hand Shell, Showing Switch and Cord Support.

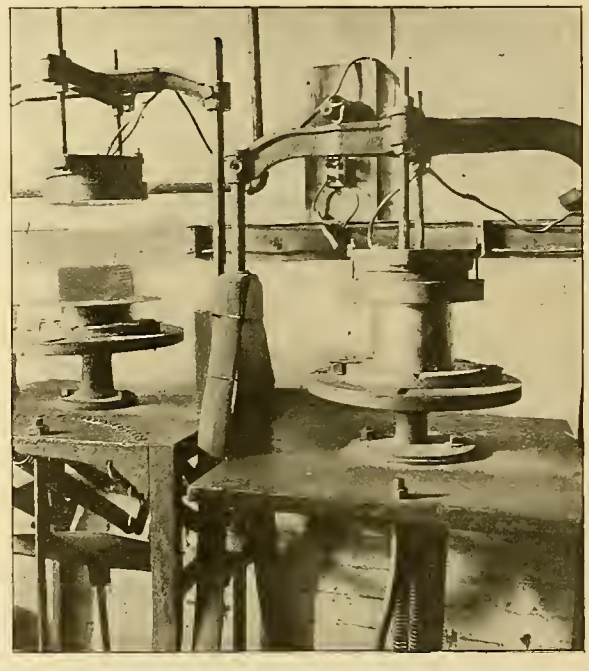


Fig. 6. Electrically Heated Pressing Machines for Straw Hats.

ELECTRICITY IN HAT MANUFACTURE.

TRIFLING TECHNICALITIES.

"Did you know our horse balked yesterday?"

"Gracious! What did you do?"

"Hitched an automobile to him and dragged him home."—Indianapolis Journal.

A young hopeful sat in the window a long time the other night during a thunderstorm, and contemplated the scene with a wise look on his face. Then he turned to his mother and said: "Mamma, the angels are scratching matches on the sky."—Household Words.

Worse than near thunder
Fear the blue wonder
Of the live wire;
See where it spirtles,
How its spark hurtles
Hatred and ire!

Serpentlike swinging,
Hissing and stinging,
Mighty its wrath;
Glancing and flaming,
Slaying and maiming,
Frightful its path.

Man's faithful servant,
Quick and observant,
Sparing no breath;
But as his master,
Fraught with disaster,
Danger and death.

—Chicago Daily News.

placed at convenient points throughout the buildings. The secondary windings are for 104 volts. The switchboard is of the skeleton type, with main and throw-over switches and instruments. There are 500 16 candle power lamps for lighting. No arc lamps are used, but 300 candle power Mogul incandescents are installed in the bleach house. The electrically heated appliances in use are hand flats, glue pots, pressing irons, press machines, tip-printing presses, machine ironers, etc.

Referring now to individual appliances, Fig. 1 (p. 89) shows a hand shell with switch and cord support. These shells are patterned after the shapes that have resulted from many years' use by journeymen hatters. Careful attention is paid in their manufacture to uniformity of temperature on bottom and sides. They are supplied with wood or iron handles, as desired, and are made in nine, 12 and 15-pound weights. The heat is varied according to use; i. e., moderate for "finishing" and very hot for "flanging" and "curling." The stand is provided with a heavy slate base, and has projections or spurs so that the shell may be supported when inclined for velouring. In installing the shells a cord support is used, which allows the shell to be moved over a considerabe distance and subjects the conducting cord to the least strain. The support swings as the shell moves on the bench, and the cord can be kept under slight tension, if desired.

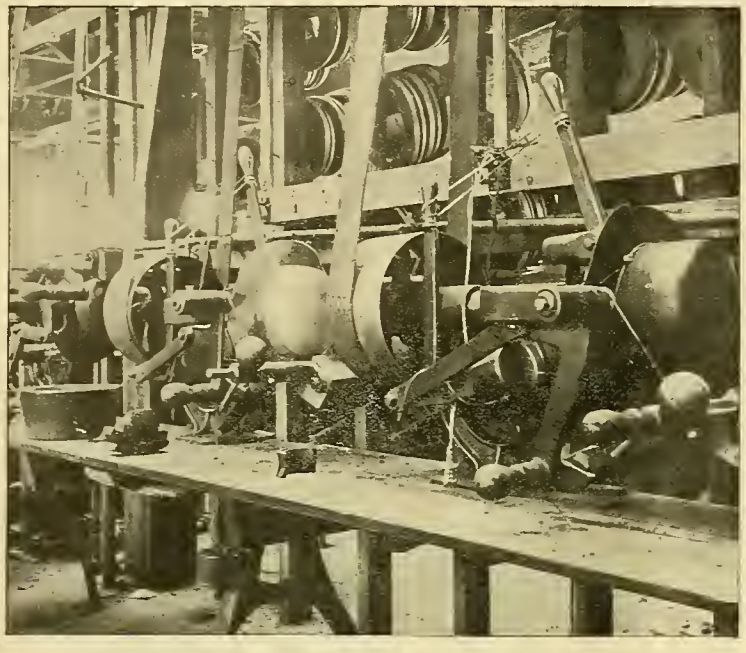


Fig. 2. Group of Electrically Heated and Electrically Driven Ironing Machines.

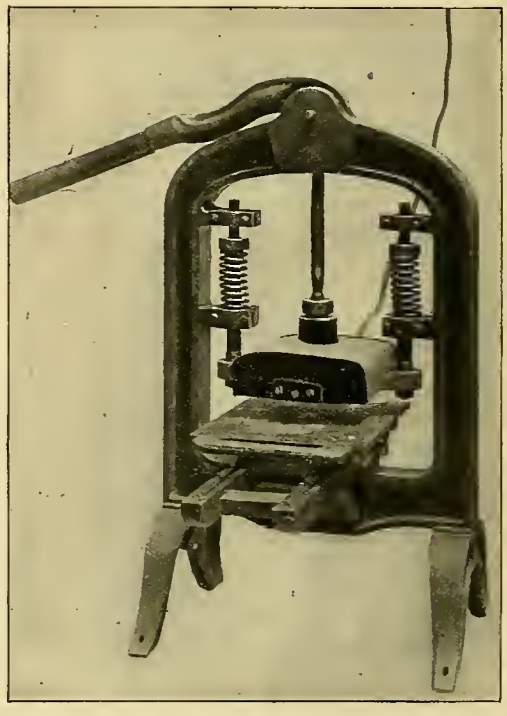


Fig. 3. Electrically Heated Press Head.

ELECTRICITY IN HAT MANUFACTURE.

In Fig. 2 is illustrated some of the ironing machines in the finishing room of the factory of F. Berg & Co. The machines are electrically heated and electrically driven.

Printing and embossing-press heads offer an exceptionally good field for the adaptation of electric heating. The heat is applied directly to the head, and obviates the "flashing" method of heating previously in general use. The work is kept perfectly clean, the heat is steady and the product correspondingly better. The heaters are made in sections, so that by the controlling switch a number of heats can be secured, according to the work being done. Fig. 3 shows the type usually heated by "flashing" with a gas flame, in which the heaters are now made a part of the internal construction of the head.

The soft-hat curling machine, in which, by the old method, a revolving disk is heated by a Bunsen burner, affords a novel mode of applying electric heating and obviates the dirt which is deposited on the disk, and then on the hat, by the gas burner. An electric heater, semicircular in shape, is pressed firmly against the revolving disk, and the heat is imparted to the disk by conduction. The heater made in this form can be properly protected, so that the heat loss may be reduced. One of these machines is shown in Fig. 4.

An internally heated flanging bag is illustrated in Fig. 5 (p. 91). The heater is placed inside the bag and every time a hat is flanged the sand is stirred, keeping the heat uniform over the working surface. The amount of energy required is said to be very small. While working, the bag may be supported upon an asbestos pad or may be suspended and the hat block pressed against it. The latter combination is similar in effect to the presses used in straw-hat manufacture. Each bag is equipped with a regulating switch, so that the heat may be rapidly brought up and then maintained at the right temperature.

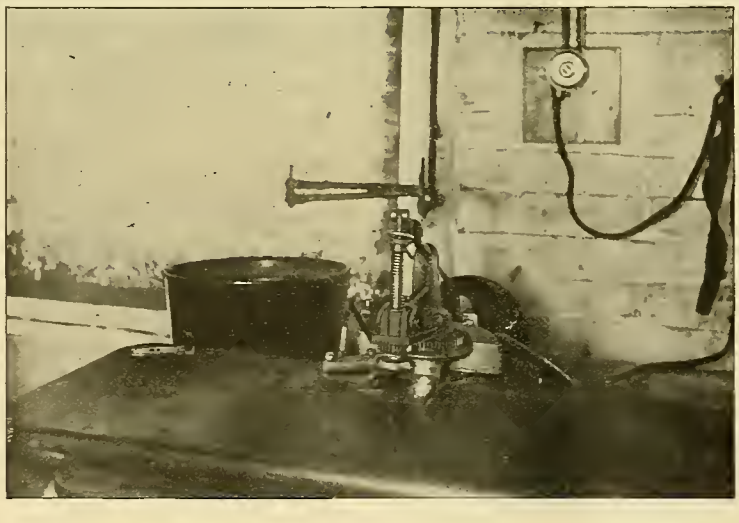


FIG. 4. ELECTRICITY IN HAT MANUFACTURE.—SOFT-HAT CURLING MACHINE.

Fig. 6 (p. 89) shows an electrically heated pressing machine used in straw-hat manufacture. As usually employed, these machines are heated by gas; the dies become sooty, and there is trouble in distributing the heat uniformly over the whole surface. The electric heater becomes a part of the die, and being contained in it the heat is well diffused by the conduction of the metal. For the top section of the press the electric heater provides a clean and uniform source of heat, with the advantage over steam of control of temperature. These are also made in sections in which the brim plate is heated by steam and the crown by electricity. This is particularly effective, as the steam gives an initial temperature of 280° Fahrenheit, and the electric heater is used to give temperatures above this point. They are made with the bottom part entirely heated by steam and the top part heated electrically. With electrically heated presses there is said to be no sticking of the brims or crowns to the dies. The use of steam in combination with the electric heater is desirable, for in heating up, the top and bottom parts are brought together, and the heating up is done rapidly by steam, and when separated the electric heater holds the temperature.

A machine ironer for straw hats is shown in Fig. 7. The hat is rotated on an eccentric lathe. As it rotates a wet cloth is wound upon it, and the machine-iron shell is pressed down upon it, steaming the straw. The cloth is then unwound and the hat "ironed off" with the same shell.

Fig. 8 illustrates a type of stove used for heating pressing irons and irons for moderate-temperature work in place of irons having a heater on the inside. For many purposes they reduce the installation cost, do away with cords, which become worn, serve as a stand for the irons and reduce the operating cost. An internally heated iron radiates over its entire surface and must have a stand to set upon. The stove reduces the radiation loss so that two irons can be heated with less energy than is used by one internally heated one.

Distressing Trolley-car Accident in Connecticut.

A very serious accident occurred on the new extension of the Shelton Street Railway company between Shelton and Bridgeport, Conn., on the afternoon of August 6th. The accident was caused by a car dashing off the trestle at the Oronaque bridge, while running at high speed. The scene of the disaster is locally known as Peck's Pond, over which the trestle was erected. The car was filled with passengers from Bridgeport. When it struck the eastern end of the bridge the wheels of the forward truck jumped the track. The car plunged on a hundred feet out on the bridge and then toppled over the side of the bridge and fell into the ravine below. The car turned completely over in dropping the 50 feet to the ground below and the trucks and motors came down on top of the passengers and crushed the life out of many of them.

The exact number of people on the car was not known at the time of the disaster. Twenty-nine passengers were killed and 12 were seriously injured. The officers of the company have refused to discuss the accident, and it is not known why the car jumped the track. Motorman George Hamilton was arrested on a charge of manslaughter.

Consul Kenneday of Para, who recently took a trip up the Amazon on the U. S. S. Wilmington, says: "The splendid electric railway established at Manaos, of which Dr. Hebblethwaite is manager and Mr. Charles R. Flint principal stockholder, is now being operated. It is 15 miles in length, thoroughly equipped with all modern improvements, and is certain to prove a paying enterprise."

A Self-recovering Coherer and the Study of the Cohering Action of Different Metals.[1]

By J. Chunder Bose.

In working with coherers made of iron or steel, some special difficulties are encountered in the warm and damp climate of Bengal. The surface of the metals soon gets oxidized, and this is attended with variation of sensitiveness of coherer. The sensitiveness, it is true, does not altogether disappear, but it undergoes a considerable diminution. The presence of excessive moisture in the atmosphere introduces another difficulty. Substances to be experimented on become more or less opaque by absorption of water vapor. As fairly dry weather lasts in Bengal only for a few weeks in winter, the difficulties alluded to above are for the greater part of the year serious drawbacks in carrying out delicate experiments. To avoid as far as possible the partial loss of sensibility of the receiver due to oxidation, I tried to use metals less oxidizable than iron for the construction of the coherer. In my earlier experiments I derived considerable advantage by coating the steel spirals with deposits of various metals. Finding that the sensitiveness depends on the coating metal and not on the substratum, I used in my later experiments fine silver threads wound in narrow spirals. They were then coated with cobalt in an electrolytic bath. The coating of cobalt was at first apt to strip off, but with a suitable modification of the electrolyte and a proper adjustment of the current, a deposit was obtained which was very coherent. The contact surface of cobalt was found to be highly sensitive to electric radiation, and the surface is not liable to such chemical changes as are experienced in the case of steel.

I next proceeded to make a systematic study of the action of different metals as regards their cohering properties. In a previous paper[2] I enumerated the conditions which are favorable for making the coherer sensitive to electric radiation. These are the proper adjustment of the electromotive force and pressure of contact suitable for each particular receiver. The electromotive force is adjusted by a potentiometer slide. For very delicate adjustments of pressure I used in some of the following experiments a U-tube filled with mercury, with a plunger in one of the limbs; various substances were adjusted to touch barely the mercury in the other limb. A thin rod, acting as a plunger, was made to dip to a more or less extent in the mercury by a slide arrangement. In this way the mercury displaced was made to make contact with the given metal with gradually increasing pressure, this increase of pressure being capable of the finest adjustments. The circuit was completed through the metal and mercury. Sometimes the variation of pressure was produced by a pressure bulb. In the arrangement described above the contact is between different metals and mercury—metals which were even amalgamated by mercury still exhibited sensitiveness to electric radiation when the amalgamation did not proceed too far. In this way I was able to detect the cohering action of many conductors, including carbon. For studying the contact-sensitiveness of similar metals I made an iron float on which was soldered a split-tube in which the given metal could be fixed, a similar piece of metal being adjusted above the float, so that by working the plunger or the pressure bulb the two metals could be brought into contact with graduated pressure. The other arrangements adopted were the contact of spirals compressed by micrometer screw, and filings similarly compressed between two electrodes.

With the arrangement described above the action of radiation on metallic contacts was studied, a brief account of which will be given under their respective groupings. It may here be mentioned that certain metals which do not usually show any contact-sensitiveness can be made to exhibit it by very careful manipulation. The nature of the response of a coherer is to a certain extent modified by its condition and particular adjustment. A coherer freshly made is more difficult to adjust, but at the same time far more sensitive. The action is more easily under control and more consistent after a few days' rest, but the sensitiveness is not so abnormally great. The contacts of bright and clear surfaces are difficult to adjust, but such contacts are more sensitive than those made by tarnished surfaces. Pressure and electromotive force, as previously stated, also modify the reaction. For example, a freshly made and very delicately adjusted coherer, subjected to slight pressure and small electromotive force, showed an increase of resistance by the action of radiation. The galvanometer spot, after a short interval, resumed its former position, exhibiting a recovery from the effect of radiation. The coherer continued to exhibit this effect for some time, then it relapsed into the more stable condition in which a diminution of resistance is produced by the action of radiation. Another coherer was found apparently irresponsive to radiation, there being the merest throb (sometimes even this was wanting) in the galvanometer spot when a flash of radiation fell on the receiver. Thinking that this apparent immobility of the galvanometer spot might be due to response, followed by instantaneous recovery, the galvanometer needle being subjected to opposite impulses in rapid succession, I interposed a telephone in the circuit; each time a flash of radiation fell on the receiver the telephone sounded, no tapping being necessary to restore the sensitiveness. The recovery was here automatic and rapid. After 20 or 30 flashes, however, the receiver lost its power of automatic recovery, and the sensitiveness had then to be restored by tapping. An interesting observation was made to the effect that on the last occasion the receiver responded without previous tapping, a rumbling noise was heard in the telephone, which lasted for a short time, evidently due to the rearrangement of the surface molecules to a more stable condition, after which the power of self-recovery was lost.

The state of sensibility described above is more or less transitory, and is induced, generally speaking, by a somewhat unstable contact and low electromotive force acting in the circuit. In the majority of metals the normal tendency is toward a diminution of contact resistance by the action of electric waves. The occasional increase of resistance, in general, disappears when the pressure and electromotive force are increased. But in the case to be presently described we have an interesting exception, where the normal state of things is just the reverse of what prevails in the majority of metals.

Alkali Metals.

In the following investigations the radiator is a platinum sphere 9.7 millimeters in diameter. The coherer was placed at a short distance, so that the intensity of incident radiation was fairly strong.

Potassium.—In working with this metal, the exceptional nature of the reaction became at once evident. The effect of radiation was to produce an increase of resistance. The pressure of contact was adjusted till a current flowed through the galvanometer, the galvanometer spot of light being at one end of the scale. On subjecting the receiver to radiation the spot of light was deflected to the opposite end, exhibiting a great increase of resistance. When the pressure and electromotive force were suitably adjusted a condition was soon attained, when

[*Continued on page 93.*]

FIG. 8. ELECTRICITY IN HAT MANUFACTURE.—FOUR-IRON STOVE FOR PRESSING-IRONS.

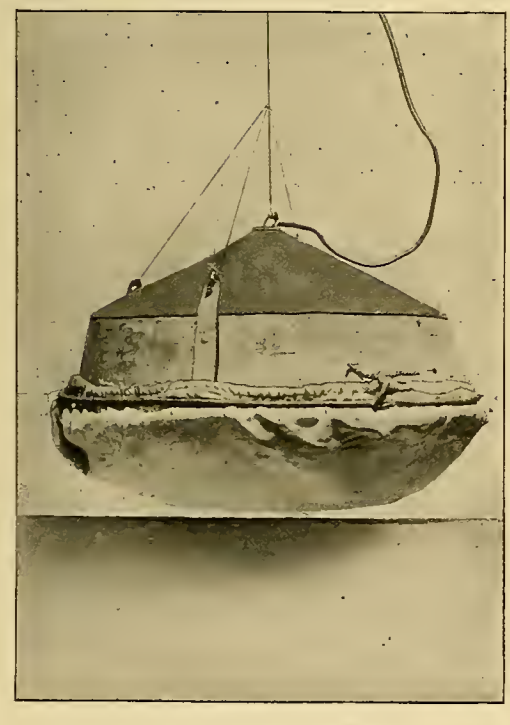


Fig. 5. Internally Heated Flanging Bag.

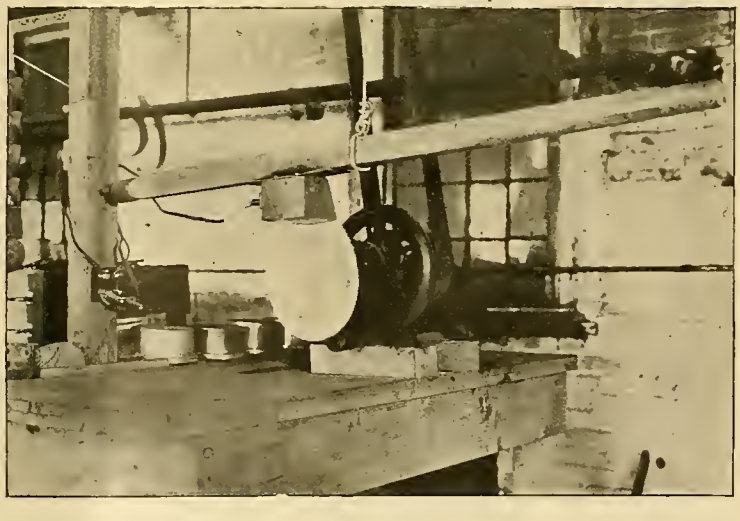


Fig. 7 Machine Ironer for Straw Hats.

ELECTRICITY IN HAT MANUFACTURE.

1. Paper read before the Royal Society of England.

2. "On Polarization of Electric Ray," Journal of Asiatic Society of Bengal, May, 1895.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

Society for the Promotion of Engineering Education, Columbus, O., August 17th to 19th.

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

New York State Electrical Contractors' association, Buffalo, N. Y., August 29th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

Conservative telephone men, whether Bell or Independent, consider it a daring experiment to set about the establishment of automatic telephone exchanges in Chicago, as the new Illinois Telephone and Telegraph company seems to have done. All friends of the Independent movement will hope that a legitimate, honest and healthy competition will be established in the city of Chicago; but at once to combat such a strongly intrenched corporation as the Chicago Telephone company and to introduce a complicated system of automatic connections that has been tried only on a small scale and which has made very little headway in public favor in the last 10 years seems to be an undertaking of great and unnecessary magnitude. We sincerely hope that the new company will give the telephone-using public the service that is demanded. If it succeeds, its success will be great, and none will rejoice more heartily than the Western Electrician. But it hardly seems the part of prudence to jeopard the hopes of the thousands who are looking for relief from the existing monopoly by combining with the effort what is at best but a colossal experiment. The automatic system should have won its spurs in a town of at least 100,000 inhabitants before coming to Chicago with its 2,000,000. And it should be shown how the automatic exchanges are to connect with the manually operated long-distance lines of the Independents that will soon radiate from Chicago in all directions. It is fair, perhaps, to give the system a trial, but there is much about it that is to be explained, and the new company should frankly take the public into its confidence.

Catch-words are valuable to advertisers, and in consequence the latest terms of electrical advancement are appropriated to attract attention to the display "ads" of the daily newspapers. Thus a Brooklyn advertiser calls attention, in bold type, to "A Wireless Telegraphy of Prices." These are merely sounding words, of course, but they catch the eye. Should the reader wonder what the title means, he will get but slender satisfaction. "It is a current saying," says the advertiser, "that on the day that General Gordon was killed at Khartoum, the people in the streets and bazaars of Cairo knew of it, though the distance in a direct line is a thousand miles, and no telegraph to connect the cities. In our own city is wireless telegraphy working. This store's phenomenal midsummer prices are in every one's thoughts. Their influence is felt and talked about far beyond the city gates. Many already know before we make an announcement that this week will have startling advantages for them. And there's a reasonable cause for such prices, too," etc., etc. And a little further along the electrical simile is again put forth: "To-morrow's offers are particularly electrical—a transmission of wireless telegraphy. Every alert shopper will detect and utilize the electro-waves of midsummer prices. Our advertisement is but a click of the instrument; the whole store is charged with the force." There isn't much hard reasoning in such an advertisement, but it is unusual and readable. It illustrates the extent to which some of the more popular electrical terms have been spread among the great American newspaper-reading public.

With the comparatively sudden increase in the volume of electrical industries in Great Britain has arisen a demand for skilled electrical engineers, progressive and up-to-date. Clear-headed young men with technical training are wanted by manufacturing companies, operating companies and municipalities. The English concerns are looking to the technical colleges of their own country for their future assistants, but it seems that, just at present, the demand exceeds the supply. It is stated that in one London school alone notices are posted to the effect that assistants are needed by eight different corporations or firms doing electrical work.

The American technical schools turn out hundreds of young men annually who have been well drilled in the first principles of mechanical and electrical engineering. It is very possible that many of them could secure employment in England now by making the effort, although it is always to be remembered that the salary standards of the two countries are very different. However, English practice is improving somewhat in this respect, and as American engineers of the first grade have made valuable connections in England, it seems probable that well-trained young men would be welcomed to subordinate positions that might pave the way to something worth while.

In the recent British naval maneuvers the cruisers Europa, Juno and Diana were equipped with apparatus for space telegraphy. The ships engaged in the maneuvers were divided into two divisions. One was supposed to be protecting a fleet of provision ships destined for an English port. The other was to endeavor to intercept the food supplies and prevent their landing. In this scheme of maneuvering the value of prompt communication from ship to ship is obvious. It is said, in a general way, that the usefulness of the new system was demonstrated, and that valuable information was transmitted from ship to ship for distances as high as 30 miles.

Signor Marconi was installed on the Juno, commanded by Captain Jackson, who is especially interested in the subject of space telegraphy. A correspondent of the London Daily Telegraph gives an amusing account of the "red-tape" methods that were observed: "Meantime a great deal of secrecy is observed on the Juno. Mr. Marconi being kept under lock and key so far as the press is concerned. It is a quaint tradition of the navy that no publicity must be given regarding even the most innocent experiments until full information has been laid before the admiralty. This practice, however, does not prevent everyone in the fleet from being kept well informed as to the exact course of events. Unlike most guests on her majesty's vessels, Mr. Marconi does not take his meals in the wardroom, but in the captain's cabin. He passes most of the day in work, and does not speak on business matters to anyone except the commander, who understands the new system in every detail. At first the receiving instrument was fixed in the chart-room on the Juno, but in order to secure greater comfort and privacy for the famous inventor, it has been transferred to his private apartment." A full report of these interesting experiments would undoubtedly be of great value to the scientific world, and no doubt it will be made made public in due time.

It would be well if the Treasury Department would make a more definite classification of the electrical exports of the United States. For instance, in the official report of the exports of domestic merchandise for the year ended June 30, 1898, these items and values are given: Brass and manufactures of, $1,320,093; carriages, cars, other vehicles and parts of for other railways than steam, $260,393; manufactures of copper, $1,105,236; instruments and apparatus for scientific purposes, including telegraph, telephone and other electric, $2,770,803; electrical machinery and machines and parts of, $2,052,564; lamps, chandeliers and all other devices for illuminating purposes, $672,010; miscellaneous manufactures of zinc, $88,423.

It will be seen that with the exception of the electrical machinery entry all the items given may be composed of electrical and non-electrical exports. Of course, the government has its own methods of making classifications, but why are we not told, for instance, what lamps are electrical, what are for gas and what for oil? What part of the brass, copper and zinc manufactures are of electrical apparatus? What portion of the railway cars and vehicles "for other railways than steam" are for electric roads? Why cannot the exports of scientific instruments, telegraphs and telephones be recorded separately instead of in a lump sum? And, finally, why cannot we know just what the "electrical machinery and machines and parts of" consist of? Satisfactory answers to these questions would gratify many electrical men who have been baffled by the government's figures when endeavoring to arrive at the exact amount, in value, of the electrical exports of this country, either in gross or in any particular line.

One thing is certain about the electrical export trade of the United States, however, and that is that it is increasing. A Washington correspondent of the Western Electrician estimates that the "instruments and apparatus for scientific purposes, including telegraph, telephone and other electric," exported for 1899 will reach $4,000,000 in value. Great gains in the class of electrical machinery exports are also expected to be shown by the official report for this year.

A Self-recovering Coherer and the Study of the Cohering Action of Different Metals.

[*Continued from page 91.*]

a flash of radiation made a spot of light swing energetically in one direction, indicating an increase of resistance; the receiver, however, recovered instantaneously with the cessation of radiation, and the spot violently swung back to the opposite end, indicating the normal current that flows in the circuit. This condition was found to persist, the receiver uniformly responding with an increase of resistance followed by automatic and instantaneous recovery. To prevent oxidation the receiver was kept immersed in kerosene. When the receiver was lifted from the protecting bath, it still continued to respond with an increase of resistance, but with a gradual loss of power of automatic recovery. This power was again restored on again immersing the coherer in kerosene. The receiver in vacuo, or under reduced hydrogen pressure, would have been preferred, had the necessary appliances been available.

Sodium.—As we pass from potassium to the neighboring metals, there is a gradual transition of property as regards the nature of response to electric waves. With sodium the adjustment is a little more difficult than with potassium, but the response is somewhat similar to that of potassium. Though in general there is an increase of resistance produced by electric radiation, there are occasional exceptions when a diminution of resistance is produced. With some trouble the adjustment could be made so that the recovery is also automatic, but it is not so energetic as in the case of potassium.

Lithium.—Specimens of this metal not being available, I obtained a deposit of it on iron electrodes by electrolysis of the fused chloride. The action produced by electric radiation was sometimes an increase and sometimes a diminution of resistance, the increase of resistance being the more frequent. With some difficulty it was possible to adjust the sensitiveness so that the recovery was automatic, but it was not energetic, nor did this power persist for a long time.

Metals of the Alkaline Earth.

Pure metals of this group being not available, I had to rely on the deposit obtained by electrolysis. Chloride of calcium was fused in a crucible and deposits were produced on iron cathodes, the anode being a carbon rod. The deposit was not very even. One of the iron rods with the deposit was tested by immersion under water, when hydrogen was evolved. I did not succeed in getting deposits of either barium or strontium, the temperature available not being sufficiently high.

On making a coherer with calcium, and keeping it immersed in kerosene, an action similar to that produced by sodium was observed. The tendency of self-recovery was, however, very slight.

Magnesium, Zinc and Cadmium.

In these metals and in the succeeding groups there is a pronounced tendency toward a diminution of resistance by the action of electric radiation. Magnesium being easily oxidizable, there is a thin coating of oxide on the surface. When this is scraped, the metal makes a very highly sensitive receiver. The adjustment is not difficult, the metal allowing a considerable latitude of pressure and electromotive force. It has already been stated that the metals which are slightly tarnished can be more easily adjusted.

Though there is in this metal a decided tendency toward a reduction of contact resistance, yet it is possible by careful adjustment to obtain an increase of resistance. Indeed, it is sometimes possible to so adjust matters that one flash of radiation produces a diminution of resistance, and the very next flash an increase of resistance. Thus a series of flashes may be made to produce alternate throws of the galvanometer needle. The more stable adjustment, however, gives a diminution of resistance, and receivers made with this metal could be made extremely sensitive. The tendency toward recovery is almost wanting.

Zinc.—This metal also exhibits moderate sensitiveness; it, however, requires a more careful adjustment.

Cadmium.—The action of this metal is somewhat similar to that of zinc, but the sensitiveness is very much less.

Bismuth and Antimony.

Both bismuth and antimony make very sensitive receivers. Moderately small electromotive force with slight pressure is best suited for these metals.

Iron and the Allied Metals.

Iron.—The action of this metal is well known. In one of my experiments I used it in connection with mercury. When the contact is very lightly made, there is a tendency toward an increase of resistance by the action of radiation. But after a time the action became normal; that is to say, there was a diminution of resistance.

Nickel and Cobalt.—These are also very sensitive. The surface being bright, the electromotive force and pressure are to be adjusted with some care.

Manganese and Chromium.—These were obtained in the form of powder. Their action is similar to the other metals of this group.

Aluminum.—This also makes a sensitive receiver.

Tin, Lead and Thallium.

It is somewhat difficult to adjust tin, but when this is done the metal exhibits fair sensitiveness. Lead is also sensitive. The sensitiveness of thallium is only moderate.

Molybdenum and Uranium.

The specimen obtained was in the form of powder and very tarnished in appearance. The sensitiveness exhibited was slight.

Metals of the Platinum Group.

Platinum exhibited a moderate amount of sensitiveness. Spongy platinum also showed the same action. The absorption of hydrogen made the action slightly better, but the improvement was not very marked.

Palladium.—This made a more sensitive coherer than platinum. The adjustment is, however, more troublesome.

Osmium.—The specimen was in the form of powder. It requires a higher electromotive force to bring it to a sensitive condition. The sensitiveness was moderate.

Rhodium was found to be more sensitive than osmium.

Copper, Gold and Silver.

Copper required a much smaller electromotive force. The sensitiveness was only moderate.

Gold was more difficult to adjust, but the action is a little stronger.

Silver.—The receiver was extremely unstable. It exhibited sometimes a diminution and at other times an increase of resistance.

Conclusions

It will be seen from the above that all metals exhibit contact sensitiveness to electric radiation, the general tendency being toward a diminution of resistance.

The most interesting and typically exceptional case, however, was the receiver made with potassium, which not only exhibits an increase of resistance by the action of radiation, but also a remarkable power of self-recovery. In the accidental instances of increase of resistance exhibited by other metals, an increase of pressure or electromotive force generally brought the coherer to the normal condition, which showed a diminution of contact resistance by the action of electric waves. With potassium I gradually increased the pressure till the receiver grew insensitive. All along it indicated an increase of resistance, even when one piece was partially flattened against the other. I increased the electromotive force many times the normal value; this increase (till the limit of sensitiveness was reached) rather augmented the sensibility and power of automatic recovery. I allowed the receiver a period of rest, the nature of response remaining the same. As far as I have tried, potassium receivers always gave an increase of resistance, a property which seems to be characteristic of this metal, and to a less extent, of the allied metals.

It will thus be seen that the action of potassium receiver is not, strictly speaking, a cohering one. For it is difficult to see how a cohering action and consequent better contact could produce an increase of resistance. It may be thought that the sudden increase of current may, by something like a Trevelyan-rocker action, produce an interruption of contact. But such a supposition does not explain the instantaneous action and the equally instantaneous recovery.

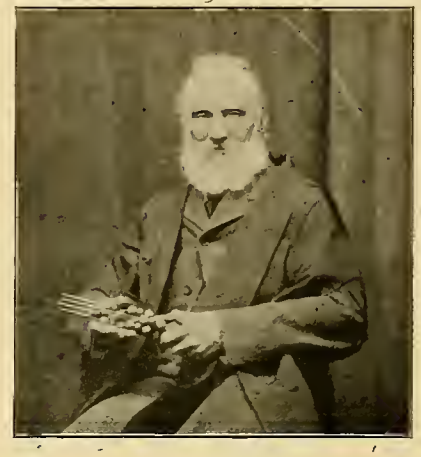
In arranging the metals according to their property of change of contact resistance, I was struck by the similarity of action of electric radiation on potassium in increasing the contact resistance, and the checking action of visible radiation on the spark discharge. In the latter case, too, potassium is also photo-electrically the most sensitive. But the action is confined to visible radiation, and is most efficient in the ultra-violet region. I was, indeed, apprehensive that the action on potassium receiver which I observed might be in some way due to the ultra-violet radiation of the oscillatory spark. But this misgiving was put to rest from the consideration that the receiver was placed in a glass vessel filled with kerosene, through which no ultra-violet light could have been transmitted. To put the matter to final test, I lighted a magnesium wire in close proximity to the receiver without producing any effect. Thick blocks of wood of ebonite and of pitch were interposed without checking the action. I then used polarized electric radiation, and interposed a book analyzer, six centimeters in thickness; when the analyzer was held parallel there was a vigorous action, but when it was held in a crossed position all action was stopped. No visible or heat radiation could have been transmitted through such a structure, and there can be no doubt that the action was entirely due to electric radiation.

It would be interesting to investigate whether the observed action of electric radiation on a potassium receiver is in any way analogous to the photo-electric action of visible light. I have commenced an investigation on this subject, the results of which I hope to communicate on another occasion.

Retirement of Lord Kelvin.

Very cordial and sympathetic wishes of good-will will follow Lord Kelvin in his retirement from the chair of natural philosophy at Glasgow University. For over 50 years this eminent man has held a professorship in the university, and now, at the age of 75, he retires with a well-won reputation as perhaps the first man of science now living. His name will rank high on the honor roll of the nineteenth century, and he will stand with such men as Davy, Faraday, Maxwell, von Helmholtz and Henry. Both in pure scientific investigation and in practical application he has labored worthily for his fellowmen.

William Thompson (successively Professor Thomson, Sir William Thomson and Lord Kelvin) was born in Belfast, Ireland, on June 26, 1824. He is of Scotch-Irish extraction, the son of a learned man, and received a liberal education, graduating at Cambridge a senior wrangler in 1845. The bent of his powerful mind was toward electricity and mathematical physics, and in 1846, at the age of 22, he was appointed to the professorship at Glasgow he has now resigned, having steadily refused tempting offers to leave the Scotch institution for positions at Cambridge University and elsewhere. The accompanying portrait is from a photograph of Lord Kelvin taken in his jubilee year and shows him in his academic robes. This jubilee celebration, in



LORD KELVIN.

June, 1896, brought together a distinguished gathering of scientific men in Glasgow and elicited congratulatory addresses from 28 universities, 12 colleges and 51 societies and institutions, as well as a message from the queen.

Lord Kelvin is eminent as an inventor as well as a physicist. His mirror galvanometer rendered the early Atlantic cables economical in working, and he was knighted in 1866 for his aid to transatlantic telegraphy. His siphon recorder was an improvement, and he has invented other valuable aids to submarine-cable laying and navigation. His electrical measuring instruments are well known. In 1892 Sir William Thomson became Baron Kelvin. He is an ex-president of the Royal Society and has received many other honors. Lord Kelvin has surveyed the whole field of electricity and magnetism, as his published works and inventions show. He was consulted in relation to the Niagara Falls project, and on his last visit to the United States, two years ago this summer, he inspected the electrical plant at the Falls with great interest His appointment as the technical adviser of the new British Westinghouse Electric and Manufacturing company is a late announcement.

International Electric-railway Bridge Opened.

The new suspension bridge across the Niagara River was formally opened on July 21st by the International Traction company. The bridge was beautifully decorated with United States and British flags, and processions proceeded from each end and met in the center, while the band played the tune to which "America" and "God Save the Queen" are sung. After congratulations the guests adjourned for luncheon, at which Hon. W. Caryl Ely, the president of the company, presided.

The bridge is the only structure of the kind now crossing the Niagara River, all the old suspension bridges having given way to steel arches. It has a cable span of 1,040 feet and a suspended span of 800 feet. The width of the roadway is 25 feet, and through the center of the floor runs a single track for electric cars. Double tracks are laid on the approaches at either end. In appearance the bridge is very graceful, and its service will add materially to the delights of a trip to Niagara.

The Staten Island Rapid Transit Railway company has been incorporated in New York, with a capital of $500,000. The directors include J. F. Emmons, J. V. Smith, James M. Davis, O. S. Wood, L. Hall, Louis L. Stanton. It is a reorganization of an old company of the same name.

DEVELOPMENT OF THE TELEPHONE FIELD.

Illinois Telephone and Telegraph Company.

An aggressive campaign has been begun by the Illinois Telephone and Telegraph company, organized to compete with the Chicago Telephone company in this city. The company has opened a suite of offices at 721-723 Rookery building, adjoining and connected with the offices of the Strowger Automatic Telephone company. In advertisements of the new Illinois company Albert G. Wheeler's name is appended as president and L. H. Allen's as contracting agent. M. A. Meyer is president of the Strowger company and J. Harris is secretary. It is stated that the Strowger automatic apparatus will be used, although this fact is nowhere officially and publicly announced by the company. A circular has been sent to the subscribers of the existing company, in which present telephone devices are decried without giving much information about "the more modern ones." Following is the text of the circular:

The value of the telephone of to-day is in the number of subscribers and the efficiency of its service.

The telephone instruments and appliances now in use are antiquated.

This is an age of progress and improvement, and equally rapid strides have been made in the development of the telephone as of every other device and invention in general use, but the very large amount of money already invested throughout the country in the old-style instruments and switching devices, and the immense sacrifice that would be caused to the existing telephone company by abandoning and throwing away these devices and substituting for them the more modern ones, has deprived the public of the benefit and advantages of these modern improvements which it should have enjoyed long since, at a price much less than the present rates, and without the arbitrary conditions imposed under the old (the present) system.

This company will begin its operations by providing for at least 30,000 telephones, not on philanthropic principles, but as a business proposition, between the subscribers and investors, it being a known fact that a fair profit can be realized by furnishing very superior service equipped with the most modern automatic instruments at the rates provided by our ordinance.

We respectfully request you to become one of the first subscribers to the Illinois Telephone and Telegraph company, which will establish a telephone system in the city of Chicago, under the ordinance granted to it in February, 1899, at such reasonable rates that the use of the telephone will be enormously increased.

The exchanges installed by this company will be strictly first-class; every instrument will be adapted to long-distance service with metallic circuit, and no party lines, so that service may be furnished without any possible interference or delay to the greatest number of subscribers. To facilitate our construction in all parts of the city, it is important that you sign and return the enclosed contract and duplicate at once.

We hope for the immediate co-operation and assistance of the long-suffering public in this regard, and we will reciprocate with the most modern equipment, satisfactory service and reasonable prices.

We, therefore, ask you to become a subscriber, and assure you that the policy of the management will be to provide service that will be prompt, private and perfect.

The enclosed contract is in duplicate and provides for payment to the Illinois Telephone and Telegraph company, "its successors or assigns," of the sum of $85 a year for a telephone equipment for business houses, provided, however, that there shall be no charge until 5,000 instruments are in use; then the rate for business telephones is to be $50 a year until 10,000 instruments are in use, after which the regular $85 rate will be established. The regular annual rate for a residence telephone is $50 a year. A provision of the contract is that a rebate of the first quarterly payment will be allowed to the first 10,000 subscribers. There are paragraphs providing for due care of the instrument by the subscriber, giving the company the right to remove the instrument in case of non-payment of rent, asserting that the instrument shall be used only by lessee or on the business of the lessee, and one which reads as follows:

6. The lessor shall have the right hereafter to establish all reasonable rules and regulations necessary to the conduct of said Chicago exchange and the equipments therewith connected, and the same shall be binding upon the lessee as soon as notified thereof, provided such rules and regulations shall in no manner conflict with the terms of this contract.

It is said that 2,500 orders for the new telephones were received on the first day after the circulars were issued (August 4th). By the Strowger system, it is explained, the subscriber automatically makes his own connection at the exchange by pulling a switch on the instrument as many times as there are places in the number sought—four times for thousands, three for hundreds, and so on. The switch travels a different length for each unit from 1 to 0. Thus, to call 1746, for example, the subscriber inserts a finger in a finger-hole marked 1 and pulls the switch around to a fixed projection, against which the finger strikes and prevents farther travel. Removing the finger, the switch flies back to normal, and then it is pulled a longer distance, in a similar manner, for 7, and so on for 4 and 6. The contacts thus made by the subscriber produce a series of automatic selective operations in the exchange, and if the line is not busy the caller's bell will ring and he may then take down the receiver and talk to the person desired. There are two wires only from each subscriber to the exchange. It is asserted that this system will work in practice for an exchange of 10,000 subscribers or more. At the office of the Strowger company the representative of the Western Electrician was assured that automatic exchanges working on this principle are in operation in Auburn, Perry, Geneva, Oneida, Northville, Amsterdam and Albion, N. Y.; Princeton, N. J.; Augusta, Ga.; Aiken, S. C.; Morganton, N. C.; Maryville, Kan.; Trinidad, Colo; Albuquerque, N. M.; Yuma, Ariz.; Albert Lea, Minn.; Rochester, Minn., and Coudersport, Pa. Doubters as to the practicability of the system were recommended to make inquiries at any of these places. It was said that the automatic exchanges in Auburn, N. Y., and Augusta, Ga., had 1,000 subscribers each. The engineer of the Illinois Telephone and Telegraph company is Mr. S. Potis, Jr., a well-known mechanical engineer, who designed the steam plants for several of the large power houses of the North and West Side street-railway systems of Chicago. He seems to think that the Strowger system is feasible.

It is said that the Illinois Telephone and Telegraph company will probably increase its stock from $250,000 to $5,000,000 and that a $5,000,000 bond issue may be made. On August 1st the Illinois Telephone Construction company filed articles of incorporation at Springfield, with a capital stock of $500,000. The incorporators are A G. Wheeler, Edward J. Judd and Louis J. Behan. The purpose of the newly formed company is said to be to construct a complete plant for the Illinois Telephone and Telegraph company, which has a franchise for laying underground conduits and for building and operating a telephone system in Chicago.

Talk of Absorption in Detroit.

A Detroit correspondent of the Western Electrician says that it is reported that the Bell telephone people will absorb the New or Detroit company. The rumor is unusually active among brokers. E. J. McKendree, a dealer in stocks and bonds, says that it comes to him without denial that such a deal is pending. Broker Corbett says that he has had more inquiries for Detroit telephone stock during the last few weeks than at any previous time. Many people come to him to see if they can buy stock. Broker Currie says that an amalgamation of the two companies is but natural. General Manager Forbes of the Michigan Bell company was not inclined to be communicative. He refused to answer questions unless they were reduced to writing. He denied that amalgamation of the companies was probable in the near future, but admitted that persons claiming to represent the Detroit company had made overtures within a recent date. These proposals looked toward consolidation. He said further that the negotiations now on would probably lead to nothing. He admitted that several of the largest stockholders were opposed to a union and had so openly expressed themselves. W. L. Holmes, president of the Detroit New company, refused to admit or deny the truth of the story. To every question put to him, he made answer: "I haven't a word to say."

Competition for Louisville.

New York capitalists are said to be interested in a new telephone system to be established in Louisville, to compete with the Ohio Valley Telephone company, which has had a monopoly in that city for a number of years, charging exorbitant rates. Perhaps $2,000,000 will be invested, as it is thought that the men interested will not limit the outlay. The representative in Louisville of the New York people is J. A. Steinau, who has secured the transfer of a franchise granted by the General Council to the Louisville Underground Electric Light, Telegraph and Telephone company more than 20 years ago. Dissensions arose among the stockholders and nothing was accomplished. Mr. Steinau has secured possession of the franchise after a year's hard work, but refuses to tell the price paid for it. It is understood that the Ohio Valley Telephone company will fight the new company in the courts, but Mr. Steinau says the franchise will easily stand the legal test. The sympathies of the Louisville people are with the new company, as they feel that the rate fixed by the old company for years has been an imposition.

EXTENSIONS AND IMPROVEMENTS.

The Danville Telephone company, Danville, Ill., is moving into new and more commodious office rooms, the increased patronage necessitating larger quarters. The company is installing the complete equipment of the Sterling Electric company of Chicago, consisting of a 500-number metallic board, adopted for an increase to 1,000 numbers, a 500-number metallic distributing board, and combined cable terminals and protectors for 500 metallic numbers, together with toll boards, monitor's desk, etc. The Danville company has also been making extensive improvements in the outside construction.

The Mattoon Telephone company, Mattoon, Ill., one of the most successful and progressive companies in the state, has about completed the modernizing of its entire exchange. Thousands of feet of cable have been erected, the pole lines rebuilt, and everything necessary has been done to insure the best service in the future and accommodate the constantly growing business. The old quarters have been abandoned for larger and more convenient exchange rooms. The new rooms are equipped with the apparatus of the Sterling Electric company of Chicago. The equipment consists of a 500-drop metallic switchboard, arranged for an ultimate capacity of 1,200 subscribers, a 500-number metallic distributing board, arranged for a continued increase, and combined cable terminals and protectors for 500 subscribers. The Mattoon Telephone company is now in a position to furnish prompt and efficient service to its patrons.

Victor Telephone Apparatus.

The Victor Telephone Manufacturing company of 166-174 South Clinton street, Chicago, makes a line of apparatus that is said to excel the Bell product. The switchboard is shown in Figs. 1 and 2—a front and rear view respectively. The board is recommended for completeness, compactness and stability, combined with high efficiency. In designing this board the manufacturers have used the Victor five-drop and jack section, shown in front and rear view in Figs. 3 and 4. This important detail has been greatly improved and consists of a vertical section upon which is mounted five subscribers' line drops and their corresponding jacks. The five drops which occupy the upper part of the section are invisibly wired to the jacks, leaving but 10 terminal points coming from each section to the binding-posts, which are mounted on a hard-rubber connecting strip that runs behind and at the bottom of the sections. The section wires are positively screwed to the top of binding-posts, making any use of a soldering iron, with its corrosive fumes and destructive action, inside the board, absolutely unnecessary. This construction removes all cabling from the back of drops and jacks, allowing removals and repairs to be made with the greatest ease and rapidity. Burnt-out drops, instead of being a great inconvenience and source of worry, become a comparatively trifling matter in this board.

Each drop is mounted on two standards. These standards also serve as the conductors to the drop coil. When a drop is to be removed it is only necessary to take out the two screws that fasten the coil to the standards when it is released, and a new one can be readily substituted without the use of the soldering iron and with a remarkable saving in time over the old method of mounting. The striking simplicity of this arrangement is seen at once.

The spring-jack used in these sections has shown, it is claimed, the distinct advantages it possesses

FIGS. 10 AND 11. VICTOR TELEPHONE APPARATUS.

over the types which contain bunches of flimsy springs and superficial parts. Each jack is made up of two substantial brass posts and one strong, simple spring, spaced well apart, that dust or corrosion may in no way short-circuit or weaken them. All mountings are on hard rubber. The sleeve of the jack is a highly polished brass bushing, turned true and fitting the plug snugly. The plug makes a rubbing contact with a strong german-silver spring that bears on its tip with an adjustable tension.

Twenty of these sections, placed side by side, measure 17 inches high by 20 inches wide, forming service for 100 subscribers' line drops and their corresponding jacks. Cords doubly reinforced, ending in the latest improved plugs, are provided for the cord circuits.

Special attention is called to the operator's set which accompanies this board. The transmitter is specially designed for central-station work. It is suspended by silk cords in a hard-rubber bracket. On this is placed all the metallic parts. The transmitter head is mounted in a manner that is designed to allow quick removal should trouble ever occur. The head receiver is claimed to be the most sensitive on the market, and particular care has been taken to make all parts adjustable that it may be made to fit the head of any operator, and though strong and durable, it is light in weight, and the strain on the wearer is reduced to the minimum.

The cabinet of this switchboard is artistic, of quarter-sawed oak with a piano finish, and the comfort of the operators, which is necessary to insure rapid working, has been the main consideration in its design. The hard-rubber face and the nickeled mountings give to the board a finish that is unsurpassed for beauty. Its strength enables it to stand up under heavy duty and its simplicity secures rapid operation.

Below the line jacks is the panel containing the clearout drops. These may be arranged in a single row of one, for each pair of plugs, according to the regular system of bridged or series drops, or the Victor system of supervisory signaling may be adopted. In the Victor system each plug has its own

individual clearout drop, by means of which the operator may at all times be signaled by the subscriber, just as readily as though no plug was in his jack. This allows greater rapidity of operation and avoids the aggravating mistakes and delays of the old system, amply justifying the slight additional cost, as no subscriber's line can become tied up.

The Victor company puts before the public for the first time, in this board, its new rolling-cam listening and ringing key. This key deserves the favorable comment it has received everywhere. It equals other parts of the Victor board in extreme simplicity and positive action. A top view is shown in Fig. 5 and one from underneath in Fig 6. The cam movement is obtained by the use of a pivoted lever, terminating in two hard-rubber rollers, which depress or release the listening or ringing contacts, according to the direction in which the key is thrown. To listen the key is thrown forward; to ring the key is pulled toward the operator.

The convenient arrangement of the ring-back key is at once novel and indispensable. This is a small rubber push-button placed beside the listening and ringing key, in such a manner that when the hand is on the key the second finger rests over the button and a slight pressure rings the person who first called up Central. The operator has but two positive motions upon the main key and one on the ring-back. In rapid working it is necessary to have few movements, and these simple and direct. A movement from the operator with a positive stop for listening and a quick automatic release from the ringing position are advantages. The main key, having but two movements, indicates by its position whether the listening contacts are depressed or the key cut out. The key is self-restoring from the ringing position, operating automatically.

All metal parts of the board are heavily nickeled and highly polished. The unsparing use of hard rubber, finest material and best workmanship and finish are notable. The insulation is excellent. Nowhere is an important connection made on wood or fiber, all being mounted on hard rubber. The wiring is all of tinned-copper wire, protected by a quadruple covering of silk and one of linen, after which it is thoroughly saturated with beeswax.

The circuits of this switchboard are straight-metallic to the connectors on the connecting board. This allows the use of a straight-metallic, common-return, grounded or mixed system, without any change in the connections of the board. Means can be provided at the cross-connecting board to accommodate these various changes.

The Victor cross-connecting board (Fig. 7) will be found equal to the switchboard, not only in appearance and workmanship, but also in practicability and general all-around convenience. All the conductors are firmly mounted on hard rubber.

Absolute protection from serious injury to the apparatus of an exchange from lightning or heavy currents is provided on the line side by means of lightning arresters and fuse links. Each side of the circuit passes first to the lightning arrester, thence through the fuse, which is of the link form and readily repaired, to the second connector; from this by means of distributing wires the line is carried to the third connector, which forms the terminal of the desired switchboard number.

The trouble man will be pleased to see the advance in the design of the cable terminal (Fig. 8) that the Victor company presents over those in common use. These, like the cross-connecting board, have hard-rubber insulation throughout. The lightning arresters are of the carbon-block pattern. The design of this arrester is such that when a discharge takes place from the line to the ground, through this arrester, the resulting dust is thrown from the air-gap, thus avoiding the grounding of the line and the troublesome consequences that usually follow. Instead of the carbon blocks, fuse links may be substituted, should this, for any reason, be found desirable, as the same clip will hold a carbon block or a fuse link.

Many believe that a satisfactory desk telephone is still a thing of the future. They would do well to examine the Victor desk set (Fig. 9). Here beauty and usefulness have been agreeably combined. The subscriber will find it an ornament in his office. The exchange manager will possess an instrument built to defy hard usage. A frail desk set is a costly nuisance to an exchange, as not only is the subscriber who is compelled to use it inconvenienced, but also all who have to transact business with him over the telephone. The transmitter is made interchangeable, as are all parts of Victor apparatus. Means are provided for readily adjusting it to any kind of service and any degree of sensitiveness that may be desired. It is equipped with a special moisture-proof carbon diaphragm, protected at the back of mouthpiece with a light perforated metallic shield. The back electrode is a carbon disk mounted in a metallic thimble, threaded with a very fine screw thread, which gives a perfect and permanent adjustment wherever set. The whole is enclosed in a heavy, neat and highly finished nickel-plated brass case. A genuine hard-rubber mouthpiece is provided, which always retains its rich black finish. In the base are mounted all contacts of the switch, making the most convenient arrangement of this important part on the market. All operative parts are easily accessible for adjustment, and are, according to the Victor rule, interchangeable. Each instrument is provided with an induction coil proportioned to work in harmony with the rest of the apparatus.

The Peerless Victor style "C" exchange telephone (Figs. 10 and 11) is said to have no equal, and has been most favorably received by the telephone public. The transmitter is the same as that used in the desk telephone. All the conductors are taken through the transmitter arm, which is hollow and protects the cords. To remove the transmitter it is only necessary to turn a single screw, when the head is released and it can be instantly removed. The transmitters are all interchangeable, making repairs an easy matter.

This telephone has a guaranteed 12,000-ohm generator, with noiseless wide gear and a durable automatic shunt. The ringers are sensitive and give a clear signal. The hook switch has a long, stout lever. The springs are of german-silver mounted on hard rubber and all contacts are of platinum.

The woodwork is finely finished, neat and substantial. All conections are soldered and the most particular care is taken throughout the process of manufacture of each instrument, every one being fully tested before leaving the factory. In the bridging set for toll-line and party-line work an instrument has been produced, it is said, that while it does not infringe upon any patent, possesses all the advantages of the best-known model.

A very useful set for a great many uses will be found in the Victor style "H" telephone. The induction coil, ringer, generator, transmitter, receiver and switch are all mounted in the one box. For residence or intercommunicating work, this set will be found desirable. The parts used in this set are the well-known standard parts of the Victor instruments.

Telephone War on Long Island.

A recent dispatch from Freeport, N. Y., states that there is a telephone war on in that part of Long Island between the New York and New Jersey company and the South Shore company. Eighteen months ago the South Shore company was organized by local capitalists, and a large number of telephones were placed in Freeport, Baldwins, Rockville Center, Lynbrook, East Rockaway, Hempstead and Merrick. The company did so well that at its first annual meeting a three per cent. dividend was declared. The New York and New Jersey company asked permission to extend its lines, but consent was withheld for a long time, as the village trustees favored the local company. Arrangements were made, however, for the company to attach its wires to the village electric-light poles. As soon as it got a foothold it began a campaign by reducing rates to secure subscribers. In some cases telephones were offered free to those who would put them in on the stipulation that only pay-station rates for messages would be charged. It is also said that the rates of the company would be reduced to $15 a year, the same as the local company's subscribers pay. The local concern has extended its service to Wreck Lead and Long Beach. The foreign company's lines which were attached to the South Shore company's poles were cut, and some other wires have been clipped, shutting off some subscribers. The New York and New Jersey company may retaliate, and the trouble may reach the courts.

The Legislative Council of Paris, Tenn., has revoked the franchise of the Cumberland (Bell) Telephone and Telegraph company, the ground being the violation of the franchise on the part of the company in charging several patrons who use long-distance telephones $3.50 a month, when, under the contract with the city, the company is only allowed to charge $3 a month for commercial telephones and $2 for residence telephones.

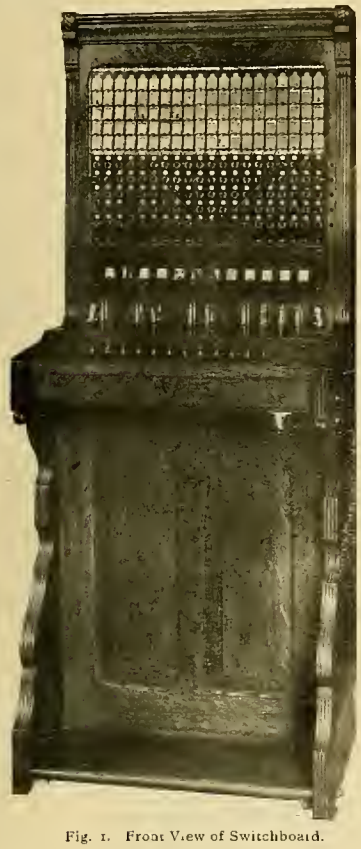


Fig. 1. Front View of Switchboard.

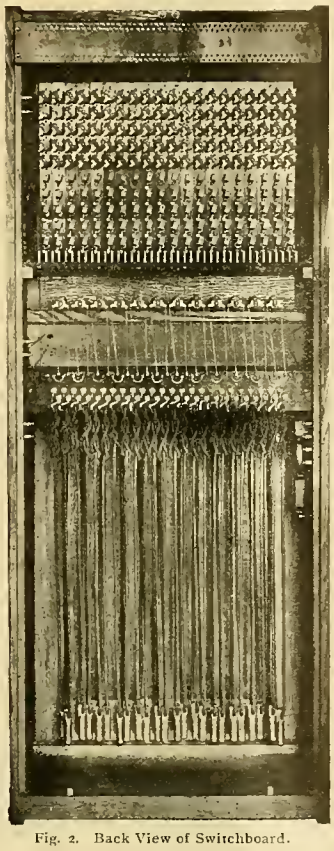


Fig. 2. Back View of Switchboard.

Fig. 3. Front View of Five-drop and Jack Section.

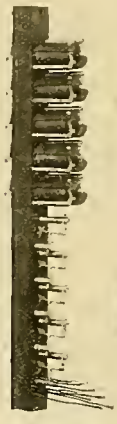


Fig. 4. Back View of Five-drop and Jack Section.

Fig. 5. Top View of Cam Listening Key.

Fig. 6. Back View of Cam Listening Key.

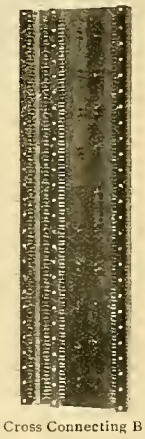


Fig. 7. Cross Connecting Board.

Fig. 8. Cable Head.

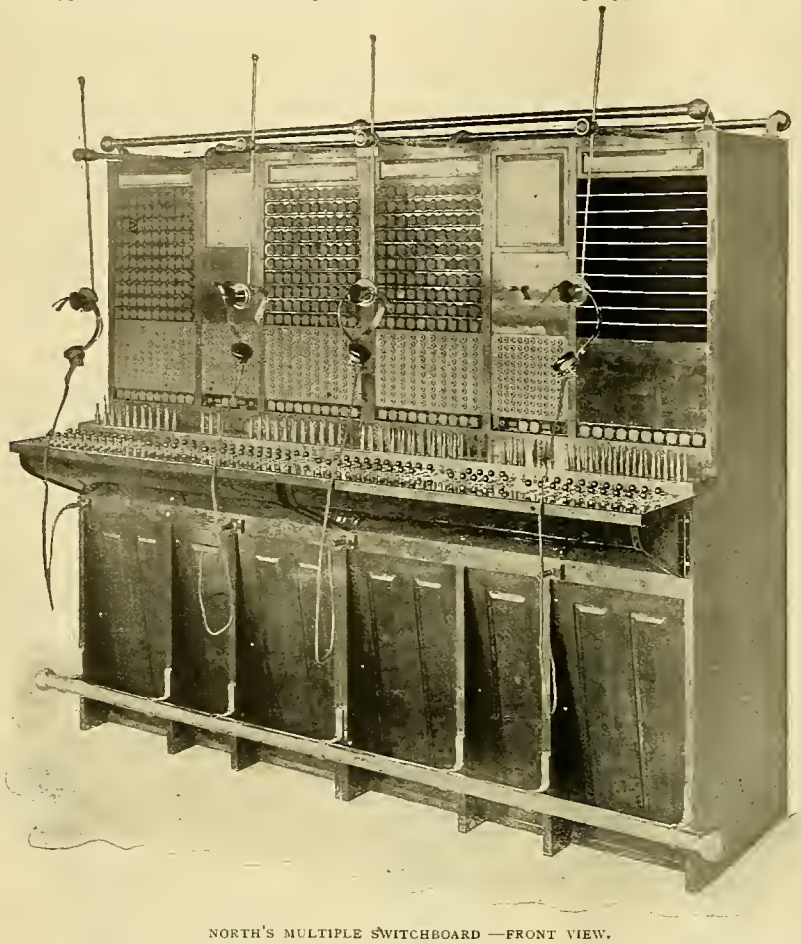
Fig. 9. Desk Set.

VICTOR TELEPHONE APPARATUS.

North's Multiple Switchboard.

Few managers of small exchanges have seriously considered the use of multiple switchboards because of the expense, as manufacturers do not seem to have furnished this type of board especially adapted to their needs. The North Electric company of Cleveland, O., now claims to fill this want, which competition with the latest Bell systems has created.

The illustrations shown represent a multiple switchboard in successful operation at Wooster, O., and of the type which the North company has



NORTH'S MULTIPLE SWITCHBOARD —FRONT VIEW.

adopted for exchanges of from 300 to 600 or 700 drops.

The switching apparatus is mounted in a beautiful dust-proof cabinet, complete in all the conveniences of large multiple switchboards and modified to meet the needs of small exchanges, which have heretofore been compelled to depend on the uncertainty and slowness of trunking systems. With this board every operator can immediately connect with the line of any subscriber to the exchange without the assistance of other operators.

The line drops and clearing-out drops in this board, as in all others manufactured by this company, are armored and wound with the best silk-insulated wire. They are mounted in banks of 10, and can be removed at will, like the line-and-multiple jacks. The jacks are strongly made, being of the best spring metal mounted on genuine rubber and all contacts soldered. The plugs and cords are guaranteed by the manufacturer to stand more wear than any other grade on the market.

Of all the conveniences introduced to facilitate the speed of the operator, it is said that none can exceed those offered in this multiple switchboard. The lever switches are made of the best spring metal with platinum contacts, and, by raising the operator's table, are easily accessible for testing and repairs. Where necessary, any single switch can be removed with little trouble. The combination of circuits offered is very complete. By the use of switch or key, the operator can throw in a reserve set of batteries for the transmitters, cut in or out the hand and power generators, the line test, repeating-coil and toll-line apparatus, night bell, pilot drops, combine all the operators' transmitters, or such as are desired, cut in the night bell or use the cord test. In fact, it is said that the board almost operates itself. The operator can leave the board at will without removing the head receiver by simply removing the plug, while the cord weights, by sliding on guide wires, never become entangled.

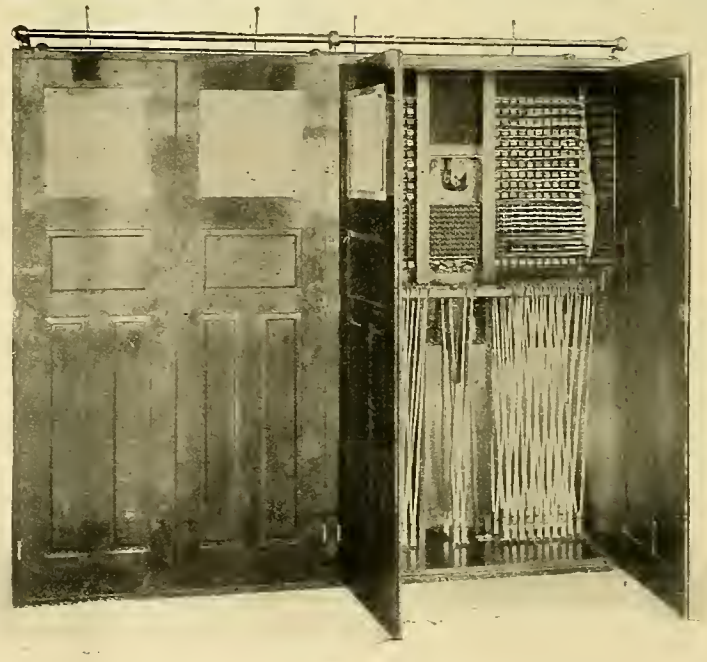
After years of observation and experience in furnishing the wants of exchanges, this switchboard is offered by the North company as the most perfect and efficient ever designed for exchanges; and in increasing the speed of the operator and giving a better service, this board should prove a "dividend payer."

The North Electric company has always made it a point to use the highest grade of workmanship and material, and in this way fortifies its claim that repair bills and maintenance are reduced to the minimum.

The company is also bringing out other new features and is manufacturing a complete line of all kinds of equipment used in telephone exchanges, and, although working night and day, it is always ready to do more business and to extend every courtesy to those who are in the market for new apparatus.

MANUFACTURERS AND DEALERS.

The telephone department of the Western Electrical Supply company, St. Louis, Mo., has issued an attractive pamphlet, covering some of the company's latest things in the telephone line, entitled "A Few Ringers." The company illustrates an attractive and thoroughly up-to-date line of series, bridging and extension bells, also a transmitter that is entirely new, thoroughly moisture and damp-proof, the transmitter proper being hermetically sealed, so that, as it is said, even immersing it in water will not affect it. To anyone interested in telephones the pamphlet should prove valuable. It will be mailed on application.



NORTH S MULTIPLE SWITCHBOARD.—REAR VIEW.

The Sterling Electric company of Chicago closed up recently what it thinks are two of the largest contracts to be booked in one day that have fallen to any of the telephone manufacturers this year. One was the equipment of the Winona Telephone company of Winona, Minn. This company has outgrown its present equipment and is rebuilding the plant. The Sterling's pole-top cable terminals and line fuses will be used in the cable work, and the complete exchange equipment of the Sterling Electric company will be installed in the new central office. The Winona company will use a 700-drop metallic tubular bridged board, which has an ultimate capacity of 1,200 drops. The second contract was with the Citizens' Telephone company of Houston, Texas, which is now constructing a plant. This plant will have an ultimate capacity of 3,000 drops and will be the largest plant in the state of Texas. The central-office or exchange equipment will consist of the Sterling tubular drop bridged boards, thoroughly equipped with the Beach-Cook automatic flashlight transfer system.

Telephony in Train Dispatching.

All of the signal towers of the New York, New Haven and Hartford railroad from New York to Boston are being connected by telephone. The line has been completed from New Haven to Port Chester, and it is expected that the New York towers will be reached in a few days. Employes of the road believe that the company was led to make the improvement by talk of a strike among the signalmen and operators a few weeks ago. It is said that this is the first attempt which has been made in America to operate a big line of railroad by the telephone system.

COMMUNICATIONS.

Madison Exchange Controversy.

To the Editor of the Western Electrician:

I understand that Mr. J. C. Harper, president of the Dane County Telephone company of Madison, Wis., has caused a report to be circulated that Mr. Glidden, president of the Wisconsin Telephone company, has offered to buy their plant, but that they had refused to sell it. I notice that Mr. Glidden has denied this report, and in the issue of the Western Electrician of July 15th Mr. Harper is reported to have said that while Mr. Glidden did not make the offer in writing to buy the exchange, he sent me there as his representative to do so.

I wrote Mr. Harper some time ago that I was not there as the representative of Mr. Glidden, and that I did not offer to buy the Dane County Telephone company's plant, and that it was only fair to Mr. Glidden, as well as to myself, that he deny the misstatements that were being circulated. Up to the present time Mr. Harper has failed to do so, to my knowledge.

In explanation of the controversy, I desire to say that as I had private business in Madison some time ago, I stopped off between trains on my way to Chicago, and while there made a friendly call on Mr. Harper, as I had become acquainted with him through previous correspondence on other matters. During the conversation Mr. Harper spoke of having had several chances to sell the plant, and I incidentally made the remark that if at any time he should desire to sell the property, I would take pleasure in presenting a proposition from the Dane County people if they had any to make, as I was somewhat acquainted with the new officers. He thanked me for the offer and said that he would take advantage of it, should he desire to make one. This was the last I thought of it, and, as I supposed, closed the incident. I was not there as a representa-

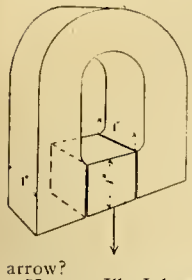
tive of Mr. Glidden or the Wisconsin Telephone company, and if Mr. Glidden had any idea of purchasing the exchange, it was not known to me.

CHAS. WEBSTER.

Waucoma, Ia., August 7, 1899.

Pull of Electro-magnet.

To the Editor of the Western Electrician:



I purpose to construct a ∩-shaped electro-magnet with a keeper placed between the poles, as shown in the sketch. The area of magnet poles, air gap and keeper is one square inch; the induction is B 12,000 to square centimeter. Perhaps some of your readers can tell me how many pounds pull will be required to remove keeper from the poles in the direction of the arrow?

J. B. H.

Harvey, Ill., July 22, 1899.

Allotment of Electrical Work in the Navy.

With the growing use of electricity on the ships of the United States navy there has arisen a great deal of friction between some of the naval experts over the installation of electric plants aboard ship, and, as a naval officer aptly remarked, "it has been the case that two separate departments would be responsible for the working of a dynamo at one end of a wire and a fan at the other." This condition of affairs has been corrected by Secretary Long by an order making a rigid allotment to the respective bureaus of the electrical apparatus which properly belongs to it. The existing regulations on the subject are insufficient, and the work has therefore been allotted as follows: To the Bureau of Equipment is given entire charge and cognizance of generators, lights, searchlights, signals and such apparatus as may be necessary for communication, fans, fire and water alarms, bells, annunciators, steering and telephone signals and electric conductors.

The Bureau of Construction and Repair will have entire charge of electric turret-turning mechanism and ammunition hoists, except those in the turrets, conformably to the requirements of the Ordnance Bureau. This bureau will also have charge of the location of fans and blowers for hull ventilation, boat cranes, deck winches, capstans and engine telemeters and electric launches.

To the Ordnance Bureau has been given the charge of ammunition hoists and rammers and elevating gear in turrets, range-finders, training and elevating gear for guns outside of turrets, air compressors, indicators and transmitters.

The location of leads will be determined by the Equipment Bureau, but only after conference with the superintending constructor.

The new order of things sharply draws the lines between the several bureaus, and the effect of this will be to do away with the personal warfare that has existed for some time, to the detriment of the public service.

Current for Electrical Entertainment from Automobile.

Mr. George W. Patterson of Chicago is an "electrical entertainer" of local renown and he has shown that he is up-to-date in his ideas. He lately gave his entertainment at the Chicago Normal Summer School, and in order to secure the current for his experiments and spectacular displays he connected a couple of wires to the battery of an electric carriage which had previously been doing good service in taking a number of the women teachers for short automobile rides.

There were 700 persons present at the evening entertainment, and each one was presented a carnation by Mr. Patterson. This introductory feature was a pleasant surprise, and firmly established the lecturer in the good graces of the young ladies.

Curious Fuse-blowing Accident.

The Rev. Carl Podin, secretary in charge of the Seaman's Institute, was seriously injured by the blowing of a fuse on a Myrtle avenue car in Brooklyn last week. Mr. Podin was riding on the front seat, when there was an explosion, and a mass of flame flew in his face. He was forcibly thrown to the street. In falling he caught a chain to save himself, and was dragged some distance. At first he tried to keep his head from hitting, but he became unconscious. The car was quickly stopped and Mr. Podin was taken to his home. The injured man sustained a severe nervous shock.

The Glens Falls (N. Y.) Electric Light and Power company and the Glens Falls Gas Light company have united, forming the Glens Falls Gas and Electric Light company, with a capital of $250,000. The directors of the new company are Frank S. Butterworth, Walter F. Peacock and Louis C. Herckenrath of New York city.

CORRESPONDENCE.

New York Notes.

New York, August 7.—Experiments in wireless telegraphy have been begun at the United States lighthouse depot at Tompkinsville, Staten Island, the work being done by William F. Clarke, a New York electrician, under the direction of Colonel David P. Heap, the engineer officer in charge of the Third Lighthouse district. A wire was run up to the top of the tall flagstaff at the Tompkinsville depot and communication was established with a lighthouse tender in the bay. No messages were sent, but bells were rung at both stations. The sending of messages from Tompkinsville to Coney Island will be attempted soon, and if this experiment succeeds experiments will follow with the Scotland, Sandy Hook and Fire Island lightships, and the Navesink lights, Romer Shoal beacon and other lights about this harbor. Mr. Clarke expects to send messages across the 40 miles between the Tompkinsville station and the Fire Island lightship.

The Western Electric company has filed plans for a 10-story brick and terra-cotta factory building, to be erected on the northwest corner of Washington and Bank streets. The dimensions are given as 105 by 143 feet. The building is estimated to cost $450,000.

The heads of all the departments of the Metropolitan Street Railway company have been invited by President H. H. Vreeland to a clambake, which he proposes giving near his farm, near Brewster, on Saturday. After the clambake a reception will be held in Mr. Vreeland's house. The clambake will not partake of the nature of a jollification over the victory which the company gained in the recent strike, as has been rumored, but is intended solely as an opportunity for the men to enjoy a day in the country.

President Rossiter of the Brooklyn Rapid Transit company has taken occasion to deny the rumors, believed to have been circulated by stock-jobbers, that he intended to resign. He said he had no trouble whatever with the directors, and that he expected to retain his place for several years The directors are all, he said, delighted with the management of the strike, which cost the company about $150,000. The earnings of the company in July were $885,875, and of the roads included in the system in the corresponding month last year, $935,474.33.

Among the cars consumed in the recent fire at the South Orange avenue car barn of the North Jersey Traction company in Newark were two of the finest private trolley cars ever built in this country. The "New Jersey" was particularly fine in its lighting and gilt trimmings. The other car, "Judge Krueger," was a "solid-comfort" vehicle, and was provided with an icebox and buffet bar; consequently it was a favorite with the men who were privileged to use it. It was ascertained that the fire was caused by lightning entering the building on the trolley wires.

The order regulating the pay of the "motormeers," as President Rossiter of the Brooklyn Rapid Transit company has called the motormen on the company's lines, has been issued and is now in effect. The men have been put into three grades, according to the nature of their work, on surface or elevated lines, and the wages for the different grades have been fixed at $2, $2.25 and $2.50 respectively. M. S.

Canadian Intelligence.

Ottawa, August 5.—The Canada Atlantic Railway company will soon commence the erection of large car shops at Ottawa, consisting of woodworking, drying and painting shops, operating them by electricity.

Mails from the letter boxes, in the larger cities of the Dominion, will soon be collected by automobile wagons, instead of as at present. An automobile wagon will shortly be put on trial in Toronto, Ont., and used for this purpose. If it is found successful, the postoffice authorities will introduce the wagons in a number of the largest cities of Canada at once. An official from the Postoffice Department at Ottawa recently made a trial run in an electric carriage in Toronto, taking the longest and heaviest mail route in that city. The result of the trip was highly satisfactory. The entire trip extended over nine miles and was covered in one hour and three minutes, including two-minute stops at each of the 11 offices visited on the route. The actual running time was not more than 35 minutes, just about half the time required by the ordinary mail wagon.

A scheme for the harnessing of the entire water power of the Chaudiere Falls of the Ottawa River is projected. A prominent electrical and hydraulic engineer of Ottawa has for some time been at work devising a means to avoid the immense waste of water, consequently of power, and has arrived at the conclusion that a canal would be the most effectual and feasible means to prevent it. Instead of having, as at present, seven or more power houses, operated by as many concerns, at the falls, one large establishment would serve for all. Not only does a large amount of water escape without being utilized, but the distribution of the water that is harnessed is very wasteful, both in head and tail races. It has been calculated that the falls can yield 160,000 horse power. A new dam will be built above the falls, and this done, practically no water need go down over the drop.

The bill providing for Canada's contribution toward the cost of the Pacific cable has passed the Dominion Parliament. The financial aspect of the undertaking is based upon the report of the imperial committee of 1897, which was favored with the advice of Lord Kelvin, the distinguished scientist. The calculation was that the cable would cost in round numbers £1,492,000. Since then an increase in the cost of the cable material has brought the proposed cost up to £1,592,000. The plan contemplates that this cost should be divided in the proportion of five-eighteenths each by Great Britain and Canada, and two-eighteenths each by New Zealand, New South Wales, Queensland and Victoria. The board of management will consist of two members from Canada and three each from Great Britain and the Australasian colonies. Sir Sandford Fleming has calculated that the cable would earn, with a due allowance for Asiatic business, in its first years of operation, as follows: In 1902, £114,157; in 1903, £153,031; in 1904, £197,375, and in 1905, £249,144. W.

PERSONAL.

Professor W. C. Röntgen of Würzburg, of X-ray fame, has been elected to the chair of experimental physics at Munich University, in succession to the late Professor Lommel.

William P. Ryman, the first president of the Wilkesbarre and Eastern railroad and organizer of the Wilkesbarre Electric Light company, died at Wilkesbarre, Pa., on July 31st.

W. R. Mason, the St. Louis representative of the Siemens & Halske company, was in Chicago last week. Like others engaged in the electrical trade of the Southwest, he reports that the only trouble is to get the apparatus to fill the orders.

Alfred Noble, the western member of the Nicaragua Canal Commission, left Chicago August 6th for New York, to sail for Paris with the commission. Mr. Noble was tendered a farewell banquet at the Technical Club on the evening before his departure.

The New York Tribune of August 3d said: Professor George Forbes of London, the well-known electrical expert, is at Niagara Falls, the guest of the officials of the Niagara Falls Power company. Professor Forbes was connected with the power company when the harnessing of Niagara's energy was first undertaken.

Mr. H. B. Kirkland, formerly New York agent for the American Circular Loom company, who now takes the place of manager of that company, by the death of Herbert H. Brooks, stopped in Chicago for a few days last week on his way back from quite an extended trip through the West in the interests of flexible and electroduct conduit. He says that business is very good indeed.

Thomas A. Edison is spending a few days at the family cottage at Chautauqua, N. Y. Mr. Edison was interviewed at Buffalo and after learning of the arrival there of the much-delayed Davis automobile was prompted to speak as follows: "The great trouble with our people is that we rush on the road with a thing which is but half invented, instead of waiting until it is perfected in every detail. I have found that it pays to make haste slowly in these matters."

Thomas R. Mercein of Milwaukee, the secretary and treasurer of the Northwestern Electrical association, is the guide, philosopher and friend of a number of members of the association and others who propose to enjoy a three days' outing at Mackinac Island. Special rates have been secured and the trip will be made from Milwaukee by steamer to Ludington, Mich.; thence by rail to Mackinaw. The party will start on August 17th and will include several Chicagoans.

Mr. W. J. Johnston, well known in the electrical field as the late publisher of the Electrical World, has started from New York on a journey around the world, to last six months, one month of which will be spent in Japan and six weeks in India, with side trips to Korea, China, the Philippines and Java. Mr. Johnston has had this expedition long in mind, and his recent release from business cares made its execution possible. He is now in the Yellowstone Park region and is scheduled to sail from San Francisco on August 17th.

Mr. William H. Meadowcroft, so long identified with the General Electric company and its predecessors, recently tendered his resignation, having accepted the position of general manager of the Perret Storage Battery company of New York. On Friday of last week he was tendered a banquet by his many friends and associates of the Edison Lamp Works at Harrison, N. J. Mr. Meadowcroft, in a farewell speech full of pathos, referred with much feeling to the many and earnest friendships he had made and to his deep regrets at parting. His old friends united in extending to him their best wishes and Godspeed in his new field of labor.

ELECTRIC LIGHTING.

It is stated that $75,000 waterworks and electric-light bonds will soon be placed on the market at Dillon, Mont.

Mercersburg and McConnellsburg, Pa., have passed ordinances giving Philadelphia capitalists the

privilege of erecting electric-light plants in their towns.

St. Augustine, Fla., has completed the arrangements for the erection of an electric-light plant costing about $20,000.

Bonds for the construction of a municipal electric-lighting system for Ukiah, Cal., amounting to $18,000, have been sold.

Cullman, Ala., has asked for bids on the erection of water and electric-light plants, for which $35,000 bonds were issued recently.

The York (Pa.) Light, Heat and Power company has contracted for the building of a new power house, to be finished by October 1st. It will have a capacity of 700 horse power.

The Porterville (Cal.) Light and Power company, with a capital of $10,000, has been incorporated by A. G. Wishon, J. F. Boller and W. H. Hammond. The company will receive power from the Mount Whitney Power company.

Abbeville, S. C., has granted a contract for municipal lighting to Sayer & Lee. This firm has purchased water rights on Little River, near Abbeville, will develop the power of the same and transmit it for lighting and power purposes.

The Huntsville (Ala.) Electric Light company has been organized by T. C. du Pont, John H. Waters, N. F. Thompson and F. J. Thompson. The company has purchased and will enlarge the Huntsville Electric Light and Power company's plant.

The Commerce Electric Light company of Commerce, Texas, has been incorporated, with a capital stock of $10,000, to construct and operate an electric-light plant, by W. B. DeJarnett, T. U. Thompson, L. W. Rutland, J. D. Jernigan and C. C. Kennedy.

The Tuxedo Electric Light company of Tuxedo, Orange County, New York, has been incorporated, with a capital of $80,000. The directors include Pierre Lorillard, Jr., Richmond Talbot, George Griswold and Charles S. Patterson of Tuxedo Park, and W. P. Homans of New York city.

Colonel A. H. Leftwich of Lynchburg, Va., has purchased 75 acres of land in Amherst County, opposite Reusens, Va., including water rights, which he will organize a company to develop. An electric plant for transmitting the current for lighting and power purposes will be erected.

The Rochester (N. Y.) Democrat and Chronicle states that W. Stanley Bruen, the superintendent of the Penn Yan Electric Light and Power company, has been appointed temporary receiver for the company. This receivership is made pending the foreclosure of the mortgage held by Henry Russell of Albany.

An interesting incident is reported from Georgetown, British Guiana, which well-nigh plunged the city into total darkness on the first night of the rainy season. The city has just installed an electric-light plant, and on this evening the arc-light lamps were completely filled with small bugs, which rendered the lamps useless for illuminating purposes.

The Verona and Oakmont Electric Light company has applied for a franchise to furnish electric lights in the borough of New Kensington, Pa. It is stated that the company is also endeavoring to secure franchises in Arnold, Parnassus, Springdale, Hoboken and other places along the Allegheny Valley. Negotiations are also in progress to purchase the municipal-lighting plant at Tarentum.

The Philadelphia Record is authority for the statement that the Southern Electric Light and Power company, which has recently been acquired by the National Electric company, is about to enlarge its plant. The addition will extend the plant from the present building northward to Christian street, making the plant cover approximately a space 200 by 400 feet. The plant when completed will have a nominal capacity of 10,000 horse power.

The Skagway Alaskan says that L. A. Mulineaux, C. C. Runner and F. R. Burnham are the promoters of an enterprise to erect a new system of electric lights in Skagway. The company, which will be known as the Alaska General Electric company, has $20,000 in cash and is ready to start construction work. The main object will be to furnish electric lights, but a telephone and fire-alarm system will also be introduced. Power will be brought from the waterfalls by means of a Pelton wheel, the power being transmitted to a distributing point in the city. It is expected to have the plant in operation by September 1st.

Walter Abbott, vice-president and general manager of the United Electric Securities company of Boston, is in Detroit to put the Detroit Electric Light and Power company once more on its feet. This concern went into the hands of Receiver Williams last fall on application of the bondholders. The larger bondholders, among whom is the United Electric Securities company, which owns the controlling interest in the bonds, have decided to do all in their power to reorganize the company on a paying basis. Mr. Abbott has declared that an entire new plant will be erected. The same building will be used, but there will be a totally new and up-to-date equipment. The reorganization leaves the stockholders out in the cold, placing the bondholders in absolute possession. It is understood that W. H. Fitzgerald will remain at the head of the new concern.

ELECTRIC RAILWAYS.

The Hartford and West Hartford (Conn.) company's suburban line to Unionville has been sold at auction to Samuel D. Coykendall of Rondout, N. Y., for $20,000.

The new electric railroad built by the Long Island Railroad company to furnish local communication between the villages between Far Rockaway and Rockaway Park was opened July 23d.

It is understood that the Boston capitalists who have bought the Terre Haute (Ind.) electric railway will build a line to Brazil, Ind., at once, and will also purchase the Brazil Rapid Transit Street Railway company.

The work on the Dudley street terminal of the Boston Elevated Railway company is to be pushed forward rapidly on the arrival of the necessary steel. It is anticipated that the entire road will be in operation a year from next fall.

The Blue Hill (Mass.) Street Railway company has been incorporated with a capital of $150,000. Charles A. Stone, E. J. B. Huntoon, Charles H. French, N. Cameron Forbes, W. E. Swan and Edwin S. Webster are the directors.

The Clinton and Hudson Street Railway company has been incorporated in Massachusetts, with a capital of $100,000. The following-named gentlemen are the officers: President, A. S. Paton; treasurer, Walter K. Dane; directors, W. S. Reed and John G. Peters.

The entire assets and property of the Newark and Granville Electric Street Railway company of Newark, O., will be sold at receiver's sale on August 26th. This system consists of about eight miles of road in the city of Newark and about seven miles of road, extending from Newark to Granville.

The entire street-railway system of St. Louis, with the exception of the St. Louis and Suburban railway, is now controlled by the United Railways company, the successor to the Central Traction company. The company is to have a capital stock of $45,000,000, when the organization is entirely completed.

The first car has been run over the Oshkosh-Neenah Interurban railroad, and the test was successful. The road, which is 13 miles in length, is the property of the Citizens' Traction company of Oshkosh, Wis., and it is stated that it will ultimately form part of an electric system between Oshkosh and Green Bay.

George R. Bullard and C. E. Sawyer of Marshall, Mich., have taken steps to build an electric railway to connect the towns of Northern Indiana and Southern Michigan. The road, if built, will become part of the interurban system projected by an eastern syndicate. The terminus of the line will be at South Bend, Ind.

There has been incorporated in Toledo the Toledo and Adrian Electric Railway company, capitalized at $25,000, to build an electric railway from Toledo to Sylvania. The line may be extended later to Adrian, Mich. The incorporators are: Frederick W. Hayes, Lester B. French, Isaac E. Kinsely, Alexander L. Smith and George H. Beckwith of Toledo.

It is stated that A. E. Orswick, manager of the electrical construction department of the Federal District of Mexico, has gone to New York with an option for the purchase of the street-car system of Guadalajara, the third city of the republic. The price asked for the 18 miles of track, plant, rolling stock and franchises is understood to be $750,000.

Through the British Thomson-Houston company of London contracts for the entire equipment of the projected Great Northern and City railway of London, England, have been awarded to the General Electric company of Schenectady, N. Y., says the New York Commercial, which also announces that the Chinese Eastern railway will require about $20,000,000 of American railway supplies.

At the recent annual meeting of the Wilmington and New Castle Electric Railway company, held in Wilmington, Del., these directors were elected: Frederick H. Treat, Peter L. Cooper, Jr., Clarence P. King, Peter J. Ford, Harry A. Richardson, Mr. Morton, H. H. Ward, H. H. Pierson and John G. Vogler. Organization was effected with Frederick H. Treat as president; Peter L. Cooper, Jr., vice-president; Clarence P. King, treasurer; Mr. Morton, secretary.

The New Jersey electric-railway system, running from Hoboken to Paterson, has been transferred to the White Line Traction company for a consideration of $4,000,000. All the trolley roads of Northern New Jersey are now controlled by three corporations, the North Jersey Street Railway company, the Orange and Passaic Valley company and the White Line Traction company. These three systems, controlled, it is understood, by Bernard M. Shanley, Garret A. Hobart, E. F. C. Young and a few other capitalists, will eventually be merged.

The Columbus (O.) Street Railway company has paid its first dividend to employes under its profit-sharing plan, adopted in May. The company pays a quarterly dividend of one per cent. to holders of stock, and has determined to pay the same dividend to employes of one year or more service, the per cent. to be figured on their yearly earnings. The average amount received was $6.50 for each man.

AUTOMOBILES.

William K. Vanderbilt, Jr., recently made a record for speed of 3½ miles in six minutes with an automobile propelled by gasoline at Newport.

The Automobile Club of London has been nominated by the Royal Commission for the Paris Exposition of 1900, to act as the consulting body, in co-operation with the commission, in reference to the automobile section of the exposition.

Elwood Haynes and E. L. Apperson have completed an automobile ride from Kokomo, Ind., to Brooklyn. The distance traveled was said to be 1,050 miles and was covered in 20 days, only about 10 of which were occupied with actual running. This is the longest automobile trip on record in the United States.

It is stated that an automobile club may be organized among the business men of Cleveland and a school maintained where men and women may become familiar with the management of the vehicles. The Cleveland Automobile company, capitalized at $500,000, of which Colonel B. Hart is manager, is doing much to aid the project.

The Riker Electric Vehicle company of Ridgeway, which has leased the plant of the Brooklyn and New York Car Supply company at Elizabethport, expects to move its entire plant from Ridgeway to Elizabeth, N. J., in a short time. The company now employs 250 hands, but expects to double this number when it gets to Elizabethport, where it is the intention to engage largely in the manufacture of automobiles.

The automobile seems to be supplanting the horse vehicles in Paris. It is stated that there are about 1,600 automobiles in the city, the larger portion of which are of the gasoline type. There is a movement on foot, however, to establish charging stations along the country roads, so that electric carriages, when making long journeys, may replenish their motive power. This will probably result in an increase of popularity for the electric vehicles.

Chicago is likely to have a system of automobiles to make its mail collections. William G. Edens of Chicago, superintendent of free mail delivery for the western division, is investigating the feasibility of the plan for the Postoffice Department, and went to Washington to recommend the use of the new vehicles. Mr. Edens spent 10 days at Cleveland and Buffalo, examining a variety of gasoline and electrically propelled vehicles and in studying practical experiments made with them. At Buffalo an experimental trip was made for his benefit. A mail carrier with an ordinary automobile made a tour of four miles in 33 minutes. During that time he collected the mail from 30 boxes, being an average of about one a minute.

PUBLICATIONS.

The Fort Wayne Electric Works, manufacturers of the Wood systems, issue a bulletin which contains matters of special interest concerning the Wood constant-current dynamos for arc lighting.

A price-list of cut-outs, switches, insulators, cleats and attachment plugs is issued by the Western Electrical Supply company of St. Louis. Extra sheets for insertion in the company's general catalogue No. 14 are also sent to the trade.

The B. F. Sturtevant company of Boston has issued the second edition of its illustrated catalogue, describing the Sturtevant engines and their adaptability for electric-light plants and general high-grade work. The company has also published new editions of its bulletins H and I, descriptive of the Sturtevant electric fans and eight-pole motors and generators.

The Oregon Short Line Railroad company has issued a very handsomely illustrated folder descriptive of Yellowstone National Park and the routes to be followed to reach and visit the park. A number of richly colored views of the geysers and mountain scenery give one a good idea of the beauties of the park. The railroad runs between Salt Lake City, Ogden, Butte and other points and connects at Monida, Mont., with stage routes for Yellowstone Park.

POWER TRANSMISSION.

It is reported at Deer Lodge, Mont., that A. A. Abbott of Butte and other Butte capitalists are going to establish an electric plant to generate power to supply the placer mines of Yam Hill, Pioneer and other camps.

The Baker City (Ore.) Democrat says that operations have commenced for the building of the proposed 3,000 horse power electric-power plant on the

North Fork of the John Day River, to supply power to adjacent mines.

The Yuba Electric Power company has made application to the Board of Supervisors of Butte County, Cal., for the grant of a franchise to erect a pole line through Butte County for transmitting and conducting electricity.

The Riverside (Cal.) Enterprise states that location papers, claiming 2,000 inches of water of the east and west forks of Snow Creek, have been recorded by Frank E. Dudley. The paper states that the water is to be used for generating electricity and in transmitting it to the larger towns in Southern California.

There is a plan on foot to make use of the water power of the Potomac and Shenandoah rivers for the production of electricity. Five water wheels that belong to a pulp-mill company at Harper's Ferry may be used to generate 3,000 electrical horse power. The electricity thus developed will be transmitted to Brunswick, Charlestown, Martinsburg and Hagerstown, to be used for light and power.

Articles incorporating the Utica (N. Y.) Electric Light and Power company, following the consolidation of the Utica Electric Light company, the Utica Electrical Manufacturing and Supply company and the Trenton Falls Electric Light and Power company were filed on June 27th. The new company will operate in Utica, Rome, Prospect, Whitesboro, New Hartford, Clinton, Frankfort, Ilion, Trenton, Holland Patent, Oriskany, Mohawk, Herkimer and other points in Herkimer and Oneida counties. The capital stock is $1,000,000, and the directors are Henry D. Pixley, Daniel N. Crouse, M. Jesse Brayton and William E. Lewis of Utica, William G. Phelps of Binghamton and Joseph Fox of New York. The company will develop the water power of Trenton Falls. W. A. Brackenridge of Niagara Falls has been engaged to take entire charge of the hydraulic development.

ELECTRICAL SECURITIES.

This was printed last week by the New York News Bureau: Although much speculation is afloat as to the causes behind the steady accumulation of General Electric common, which has had the effect of sending the price above 124, no definite explanation has been forthcoming. In one quarter it is said that the buying is upon prospects of an increased dividend. Such a move would be the natural result of the present big earnings of the company, which are reported to run as high as 20 per cent. on the common stock. The first dividend on the common stock was paid last May, at the rate of six per cent. per annum. Rumor now has it that the company will hold to this as the regular rate, and will declare extras from time to time as earnings warrant. It is the expectation of these extras that is supposed to be behind the present advance.

TECHNICAL SCHOOLS.

The announcement for 1899-1900 of the College of Mechanics and Engineering of the University of Wisconsin has been issued. It contains information relating to admission and to the course of study.

Entrance examinations for the Massachusetts Institute of Technology having been held in a number of cities, a total registration of 633 is reported. This is 78 more than last year and the largest in the history of the Institute. Of the number registered 261 are preliminary applicants for admission in 1900. A continually increasing proportion of applicants divide their examinations between two successive years. Entrance examinations will be held in Boston in September also.

Preliminary to the annual meeting of the American Association for the Advancement of Science at Columbus, O., the Society for the Promotion of Engineering Education will hold its annual meeting, the time fixed being August 17th to 19th. President T. C. Mendenhall will deliver an address. Among the papers to be read are the following: "The Essentials of a Technical Education," by Professor A. L. Rice of Pratt Institute, Brooklyn; "The Place of Correspondence Schools in Engineering Education," by Professor Edgar Marburg of the University of Pennsylvania; "Engineering Education and Expansion," by Professor W. S. Aldrich of the University of Illinois; "A Convenient Laboratory Equipment for the Study of Direct-current Dynamos and Motors," by Professor H. B. Smith of the Worcester Polytechnic Institute; "A Comparative Study of the Electrical Engineering Courses in Different Institutions," by Professor F. C. Caldwell of the Ohio State University, and "The Desirability of Uniformity in the Use of Mathematical Symbols and Terms," by Professor A. E. Haynes of the University of Minnesota.

MISCELLANEOUS.

The Eastern Oregon Power company has been incorporated at Baker City, Ore., with a capital of $100,000, to erect and operate electric-power plants for mining, milling and other purposes. The incorporators are F. Baillie, A. Geiser and J. T. English.

The Truckee River General Electric company has been incorporated, to operate principally in San Francisco, with a capital of $2,500,000. The directors are F. H. Buck of Vacaville, M. Fleishhacker, A. J. Hechtman and H. Fleishhacker of San Francisco and S. D. Rosenbaum of New York city.

Experiments in the ether-wave system of transmitting electricity were conducted at Newbury, England, recently. A small powder magazine, located 400 yards from the sending point, was electrically exploded without the use of wires. The experiments demonstrated the feasibility of using the system for destroying mines, etc., in war.

Railroad companies are rapidly fitting their freight cars with air brakes and automatic couplers. An officer of the Burlington road said in Chicago recently that on his line there are 39,000 freight cars, 60 per cent. of which are equipped with Westinghouse air brakes and 90 per cent. with Master Car Builders' automatic couplers.

This remarkable lightning exploit is told by the Cork (Ireland) correspondent of the Chicago Record: "While the Second Battalion of the Cheshire regiment, Lieutenant-colonel W. F. Curteis commanding, was marching to-day (August 4th) from the garrison at Limerick to Thurles, 34 miles east, to attend the annual maneuvers, a bolt of lightning seriously injured two non-commissioned officers and seven privates. A number of others were disabled, and hardly a man of the command escaped some sort of injury."

The provisional programme for the second annual meeting of the American section of the International Association for Testing Materials has been issued. The meeting will be held at Pittsburg, Pa., on Tuesday and Wednesday, August 15th and 16th. Business sessions will be held in the mornings and on Tuesday evening, and the afternoons will be devoted to inspection visits to the Edgar Thomson Steel Works, the plant of the Westinghouse Electric and Manufacturing company and other industrial establishments.

TRADE NEWS.

The Columbia Electric and Manufacturing company of Chicago has been incorporated, with a capital of $10,000, to manufacture electrical machines and apparatus. The incorporators are Morris M. Neurath, George M. Mayer and Emil A. Baseuer.

F. S. Hunting, sales manager of the Fort Wayne Electric Works, Fort Wayne, Ind., passed through Chicago last week on his return from a trip to Minnesota. Mr. Hunting states that his company is doing an excellent business. The Fort Wayne company has just closed some good contracts in Minnesota.

The Electrical Installation company of Chicago is favoring its friends with handsome leather card-cases. These souvenirs have the name of the recipient stamped in gold on the inside and will be prized both for their intrinsic value and as a reminder of the company. They are like the construction work of the Installation company—first-class.

There has been incorporated in Los Angeles, Cal., the Electric Supply and Fixture company, to deal in electric supplies. The directors are M. Y. Kellom, A. W. Brode, James North, Robert Gaylord and T. Broulkes of Los Angeles. The capital is $25,000.

The large increase in English orders that has come to the Bullock Electric Manufacturing company has necessitated the sending of Mr. B. W. Spellmire, its engineer of tests, to the London headquarters of the company. Mr. Spellmire will superintend the installation of Bullock machines in the United Kingdom, the first installations being in the large printing establishment of Cassell & Co., London; Nottingham Guardian, Nottingham; Birmingham Daily Post, Birmingham; Manchester Evening Chronicle, Manchester, and the Belfast Evening News, Belfast.

On the 17th of July the works of the American Electric Meter company were transferred to the board of directors by William D. Marks, assignee. On that date the assignee was discharged by the court. The company, having paid all of its debts and secured a large amount of additional capital, is prepared to take orders for meters for the two and three-wire systems, and to guarantee their operation without calibration by the user. The meter, being so devised as to have its operation unaffected by friction, will not change, it is said, with time. Once right, it is always right. The company has greatly improved its process of manufacture and has about 2,000 meters nearly completed. It is prepared to take orders in large quantities and to guarantee its meters to the fullest extent. During the last eight months Professor Marks has perfected the practical details of manufacture. In the matter of economy of current the meter, it is claimed, will be without equal, as the infinitesimal current required will only be needed when lights or power are used. A remarkable feature of this meter is the self-starting pendulum, which only swings when a load is passing.

BUSINESS.

The Missouri-Edison Electric company of St. Louis has recently taken down a lot of weather-proof wire, which has been overhauled and is now offered for sale by W. N. Matthews 312 Commercial building St. Louis, the sales agent for the company, for second-hnd material.

The Electric Appliance company, Chicago, reports a large increase of sales of its Newgard waterproof receptacle and globe. These receptacles are now made in three styles and are furnished for either Edison or Thomson-Houston base. The Appliance company has just issued a handsome circular, describing and illustrating the different styles manufactured.

The Triumph Electric company of Cincinnati is installing a 150-kilowatt, 200-revolution, direct-connected generator for Braun & Fitts, Chicago, manufacturers of butterine. This unit will be used for both lighting and power. On account of the fine regulation of the Triumph machine, it is particularly useful in supplying current for electric elevators.

One of the most valuable points relating to the use of belts is not often enough realized, or, at best, not emphasized. This is the fact that the more belt surface running in contact with the pulley the more power there is transmitted by the belt. In running a belt tight only about half of the pulley surface is in contact with the belt; therefore, if a belt can be made to run without slipping it can be run slack and very much power will be gained. The Cling-surface Manufacturing company of Buffalo, N. Y., reports that it is adding scores of belts every week to the number already running slack, through the use of Cling-surface, and of the daily letters received acknowledging this, one from Alhambra, Cal., says: "After thoroughly testing Cling-surface I find that I can run with a slack belt and get more power by far than I could with a tight belt before using Cling-surface."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 1, 1899.

629,792. Electric-signal System. Victor T. Kissinger and Arthur Trunkel, Chicago, Ill. Application filed June 5, 1899.

In an electric-signal system the combination with an electric generator of a metallic circuit connected with one pole of the generator, the other pole of which has a ground connection, a number of signal-transmitting devices included in the circuit and each comprising a brake-wheel, a co-operating contact connected with one part of the main line, and an electromagnetic motor for turning the brake wheel connected with the other part of the main line, and having a manually controlled ground connection.

629,803. Device for Electrically Lighting or Extinguishing Gas Jets. Oscar von Morstein, Schoenberg, Germany. Application filed February 17, 1896.

A device is described for electrically lighting and extinguishing any desirable number of gas jets simultaneously consisting in a combination of an electromagnetic gas-closure opener common to all the burners, with a device for producing secondary currents composed of a primary bobbin, a secondary bobbin and a circuit breaker with condenser, with a contact device provided on the gas-closure opener arranged to disconnect from the circuit the electromagnet of the gas-closure opener and at the same time increase the inductor current.

629,819. Apparatus for Automatically Discharging Guns of Warships. John A. Rowe, London, England. Application filed March 28, 1899.

This consists of an apparatus for automatically discharging the guns of a warship by means of an electric current passing in a circuit in which the guns are included, a cylindrical float submerged in a casing fixed to part of the ship, the float and its attachments being equal to the weight of the liquid displaced by it, and the float having spindles passing in a water-tight manner through the ends of the casing, in combination with means connected with the spindles and operated by the angular change in the relative positions of the float and the casing to manipulate the electric circuit and thereby fire the guns included in the circuit when the ship is upright or reaches a predetermined angle. (See cut.)

629,823. Brush Holder. Sidney H. Short, Cleveland, O., assignor to the Walker company of New Jersey. Application filed August 26, 1898.

The brushholder comprises a supporting bar arranged in a plane transversely intersecting the commutator, a series of individual brushholders mounted thereon, each adapted to receive a brush, the brushes being radially arranged with respect to the axis of the commutator, and means for adjusting the supporting bar longitudinally of the commutator. (See cut.)

629,837. Motor Control. Allan H. Whiting, New York, N. Y., assignor to Andrew L. Riker, New York, N. Y. Application filed September 27, 1898.

One claim reads: A motor, a power supply therefor, a cut-off normally admitting power to the motor but automatically cutting off the power upon the application of a brake, a controller independent of the cut-off and regulating the supply of power to the motor, and means on the controller engaging the cut-off and restoring the latter to

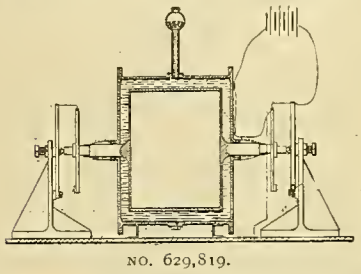
its normal position only when the controller is in the position of zero or minimum power supply.

629,870. Electric Meter. Gilbert C. Pillinger, London, England. Application filed April 10, 1899.

In combination with an electric meter, a suitably pivoted beam, a pair of recording-pens carried thereby, so that either may be operated by the meter spindle, and an electromagnet influenced by the current being measured and adapted to operate the beam.

629,872. Electric Motor. James T. Robson, London, England, assignor of two-thirds to Charles Henry Marsden and Henry William Headland, London, England. Application filed November 10, 1898.

A combined or double motor is described consisting of two electric motors mounted on the same shaft, the armature of each motor being connected with the set of field magnets of the other motor to rotate therewith, the two armatures rotating in opposite directions and the two sets of field magnets also rotating in opposite directions.



NO. 629,819.

629,897. Arrangement for Starting Alternating-current Motors. Galileo Ferraris and Riccardo Arno, Turin, Italy. Application filed July 6, 1895.

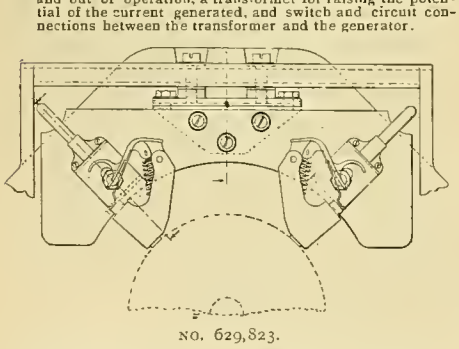
In a system of electrical transmission and distribution, the combination of a source of single-phase alternating currents, a line circuit or circuits extending therefrom, means located at a point or points by which out-of-phase electromotive forces or currents are produced from the single-phase current, electrodynamic receivers connected to the single-phase mains and capable of being connected with the conductor leading from the producer of out-of-phase electromotive force or currents, and switching devices one for each receiver normally included in and forming part of the conductor leading from the producer of out-of-phase electromotive force, and so arranged that on manipulating any one of the switching devices the circuit of the out-of-phase conductor will be broken, and the corresponding receiver will be connected to the producer of out-of-phase electromotive force.

629,898. System of Electrical Distribution. Galileo Ferraris and Riccardo Arno, Turin, Italy. Application filed October 26, 1895.

A single-phase alternating-current system of electric distribution is described, comprising the combination of high-tension mains, of an ordinary transformer, of the secondary conductors thereof, of a voltage and phase transformer having two relatively movable elements, one of which has wound thereon coils closed upon themselves, connected directly to the high-tension mains, of a connection between the secondary coil of the voltage and phase transformer to the secondary coil of the ordinary transformer, and of a single secondary conductor leading from the other terminal of the secondary coil of the voltage and phase transformer and forming with the secondary conductors of the ordinary transformer a three-branched two-phase low-tension system.

629,909. Electric Muscular Exercising Apparatus. Archie B. McMillan, New York, N. Y. Application filed June 14, 1898.

An exercising apparatus operated by drawing cords over a pulley is combined with a magneto-electric generator operated by the rotation of the pulley, an outer circuit including parts of the exercising apparatus suitably connected with the generator whereby the currents developed thereby may be caused to pass through the outer circuit, an interrupting device whereby the armature winding of the generator may be short-circuited intermittently as the armature is rotated, such interrupting device including a pivoted conducting part, whereby it may be thrown into and out of operation, a transformer for raising the potential of the current generated, and switch and circuit connections between the transformer and the generator.



NO. 629,823.

629,936. Electric Crane. James F. Tracy, Pittsburg, Pa., assignor of one-half to William H. McFadden, Allegheny, Pa. Application filed April 22, 1899.

In a crane the combination of a trolley, a standard carried by the trolley, a series of two or more contact pieces carried by the standard, each of the contact pieces being removable independent of the other pieces, and supplemental contacts adjacent to the main contact pieces.

629,952. Means for Driving Machines at Variable Speeds by Electric Motors. Walter A. Clatworthy, Newcastle-upon-Tyne, England, assignor of one-half to J. H. Holmes & Co., Newcastle-upon-Tyne, England. Application filed March 8, 1899.

This is an electrical driving device in combination with a main an auxiliary motor operating the same driving shaft and a self-releasing clutch between the motors, a sliding combination switch, a single handle adapted to reciprocate the switch, contacts, resistances and circuits connected thereto, and electrically held switches in the circuits controlling the supply current to the main and auxiliary motors, and push buttons located where desired arranged to permanently break the supply circuit to both motors upon being operated until restored by a repetition of the movements of the sliding switch.

629,957. Telephone-exchange System. George L. Cragg, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed May 16, 1898.

An operator's generator and telephone switching apparatus for telephone exchanges in combination with a single electromagnetic appliance, suitable operator's generator and telephone-circuit connections, and switching mechanism operated by the electromagnetic appliance for operatively changing the conditions of the operator's telephone circuit and for connecting the generator with and disconnecting it from a subscriber's line.

629,978. Coin-freed Apparatus for Distributing Electric Currents. Carl Bieberstein, Charlottenburg, Germany. Application filed August 26, 1898.

This is an improved apparatus for the automatic delivery of electric current to the consumer for a certain time, by insertion of a coin, having a double clockwork, the one being started by means of the coin inserted and starting in its turn after a certain time the other clockwork, which interrupts the current until it is closed again by the insertion of a fresh coin.

629,979. Electric Arc Lamp. Frederick Booker, London, England, assignor of one-half to Julius Peschek, London, England. Application filed February 28, 1899.

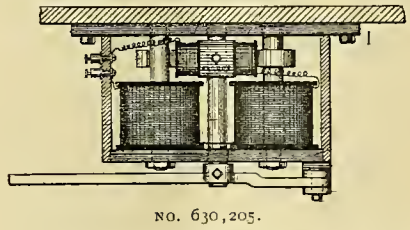
The main feature is a brake for electric-arc lamps comprising the combination of the regulating solenoids with a part fixed to the carboo suspension drums and their axle, a part loose upon the axle and rotated by the solenoids, inclined planes on the loose part co-operating with anti-friction rollers carried by an adjustable abutment in such manner that the rotary motion of the loose part is gradually imparted to the other part and to the carbon-suspension drums and by them through suitable connections to the carbon carriers.

630,071. Depolarization Substance for Electric Batteries. Gustav Platner, Witzenhausen, Germany. Application filed December 28, 1897.

A depolarization substance for electric battery cells, the substance being composed of chlorates combined with metallic salts capable of readily forming basic salts and disengaging acids or halogens.

630,076. Electric Switch. John E. Sayles, Montclair, N. J., and Henry E. Reeve, New York, N. Y. Application filed March 26, 1898.

The switch comprises a sheet-metal base having stiffening flanges and retaining lugs struck up therefrom, an insulating block secured to the base and centered between the lugs, the block having contacts thereon, and a switch lever pivoted upon the base.



NO. 630,205.

630,113. Electrically Operated Display Turntable. Max Rolle, Philadelphia, Pa. Application filed October 18, 1898.

A turn-table applicable to the display of wares and costumes, a base, a turn-table supported thereon with rolling supports, an electric motor, connected to propel the same rotatably, a commutator on the motor with two pairs of brushes alternatively applicable to the commutator, in combination with a lever controlling the brushes, and stops attached to and operated by the turntable to reverse the position of the lever and the direction of rotation of the motor and turn-table.

630,151. Automatic Telegraphy. Samuel Whitehall, South Bend, Ind. Application filed February 4, 1898.

The method consists in forming a message or design made up of parallel lines; telegraphically transmiting the lines composing the message or design; recording the lines in the form of one continuous line and then reproducing the message or design by subdividing the continuous line and arranging the subdivisions side by side to form a facsimile of the original message or design.

630,152. Automatic Telegraphy. Samuel Whitehall, South Bend, Ind. Application filed February 21, 1899.

A receiving surface for use in automatic telegraphy having the parts thereof adjustable relatively to each other.

630,153. Trolley Rail for Electric Roads. William A. P. Willard, Jr., Hull, Mass. Application filed December 24, 1898.

This describes means for electrically connecting adjacent ends of two sections of the conductor in a third-rail system, the means consisting of a covered box having in two sides opposite each other openings provided with insulating linings to receive the ends of the conductor sections and insulate them from the box, and a conducting bond adapted to receive and be bound to the conducting sections, in combination with the conducting sections, the ends of which within the box are uninsulated.

630,178. Electric Clock. Richard Bürk, Schroenningen, Germany. Application filed November 6, 1897.

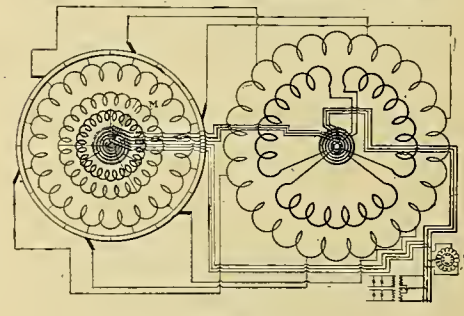
An electric clock is described having in combination a ratchet wheel, a pawl arranged to engage the ratchet wheel, means for lifting the pawl from the rachet wheel at the end of its stroke, a movable device for preventing a full entrance of the pawl between the teeth of the ratchet wheel, at the middle of its stroke, a contact device arranged to be engaged by the pawl when the pawl fully enters between the teeth of the ratchet wheel, an electric circuit arranged to be closed by the engagement of the pawl with the contact device, and a magnet included in the circuit and arranged to operate the pendulum.

630,205. Electric Motor for Brakes. Richard A. J. Evans, Chicago, Ill. Application filed February 8, 1899.

An electric motor for brakes, comprising two field pieces, field magnets thereon, an armature shaft arranged between the field magnets, an armature mounted on the shaft having projecting curved ends partly surrounding and mechanically engaging the field pieces when a current is closed through the armature and field, the armature having its windings connected in series and also connected in the field magnets, and a brake-actuating lever attached to the armature shaft. (See cut.)

630,210. Trolley Wheel. Henry R. Frisbie, Belleville, N. J., assignor of one-half to David Dodd, Newark, N. J. Application filed June 30, 1897.

The claim reads: A sectional trolley wheel consisting of a renewable center having a rim U-shape in cross section, a grooved periphery to form the contact, the rim made deeper in its central portion to enhance its wearing qualities and thereby prolong its usefulness, a hub on which side flanges are supported, a thin central web connecting the hub with the rim so that when the flanges are mounted on the hub side chambers are formed for loose graphite or other like powdered lubricant, large openings in the web to open communication between the chambers, longitudinal grooves within the bore of the hub to hold the lubricant, the bottom of the grooves provided with a plurality of openings leading into the chambers, means for uniting and holding the several sections together.



NO. 630,233.

630,233. Regulating Alternating-current Dynamo-electric Machines. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Société Anonyme pour la Transmission de la Force par l'Électricité, Paris, France. Application filed April 10, 1897.

The method of exciting an alternating-current machine, which consists in charging its field circuit or circuits with currents derived from the vector sum of two electromotive forces normally at an angle, one of which is proportional to the current streneth in the armature of the machine, and the other to the pressure at a predetermined point of the external circuit. (See cut.)

630,280. System of Electrical Distribution. Granville T. Woods, New York, N. Y., assignor to Edward L. Kerr, Jersey City, N. J. Application filed October 30, 1896.

This is a system of electrical distribution supplied with current from two sources of energy, one of which is of variable potential, the method of starting and regulating an electric motor consisting in supplying current thereto from the variable potential source, gradually increasing the electromotive force from this source until the maximum potential is reached, supplying the motor with current from both sources in parallel, opening the variable potential circuit, then withdrawing the first electromotive force, and then throwing the two electromotive forces into series and varying the electromotive force from the variable potential source.

630,283. Method of and Apparatus for Utilizing Waste Gases and Heat from Electric Furnaces. Wilhelm Borchers, Aix-la-Chapelle, Germany. Application filed March 6, 1899.

The method of utilizing the waste gases and heat from electric furnaces, consisting in effecting the electric smelting or reduction in the interior of a steam generator in the presence of an excess of the charge which remains undecomposed, filtering the gases generated in the furnace to free the same from dust particles, and cooling the molten product in the furnace.

NO. 31,317.

630,292. Electric Switch and Alarm. George W. MacKenzie, Beaver, Pa., assignor to Israel B. Chantler, Sewickley, Pa. Application filed July 16, 1898.

An electric switching device is described consisting of a stationary contact member forming one terminal of an electric circuit, a pivotal support forming the other terminal of the circuit, an arm pivotally supported therein provided with a contact member, a fusible substance thereon and a weight resting on such fusible substance, and means for operating the arm to make electrical contact upon release of such weight.

DESIGNS.

31,315. Battery-plate Separator. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery company, Chicago, Ill. Application filed July 1, 1899. Term of patent seven years.

31,316. Electrical Terminal. William B. Bragdon, Cumberland Mills, Me., assignor to S. D. Warren & Co., Boston, Mass. Application filed November 5, 1898. Term of patent seven years.

31,317. Incandescent Electric Lamp. Herman J. Jaeger, New York, N. Y., assignor to the American Miniature and Decorative Lamp company, New York, N. Y. Application filed June 17, 1899. Term of patent seven years.

The design for an incandescant electric lamp as shown in the cut.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, AUGUST 19, 1899. No. 8

Sub-station for Battery Charging at Harvey, Ill.

To provide for the new extension to Harvey an auxiliary charging station for the storage-battery railroad operated by the Chicago Electric Traction company has been erected at the suburb named. This company has had in successful operation for some time an electric line connecting the South Side of Chicago with South Englewood, Morgan Park and Blue Island, and operated by storage batteries. The main line now extends from Sixty-third street and South Park avenue south through Auburn, South Englewood, Washington Heights and Blue Island to Harvey, ending at One-hundred and Fifty-fourth street, near the Illinois Central depot. Morgan Park is reached by a branch line which starts at Seventy-ninth and Halsted streets, and follows the main line to One-hundred-and-eleventh street, then turning west to Morgan Park. Sixteen miles is the length of the main line, while the Morgan Park line is seven mile long.

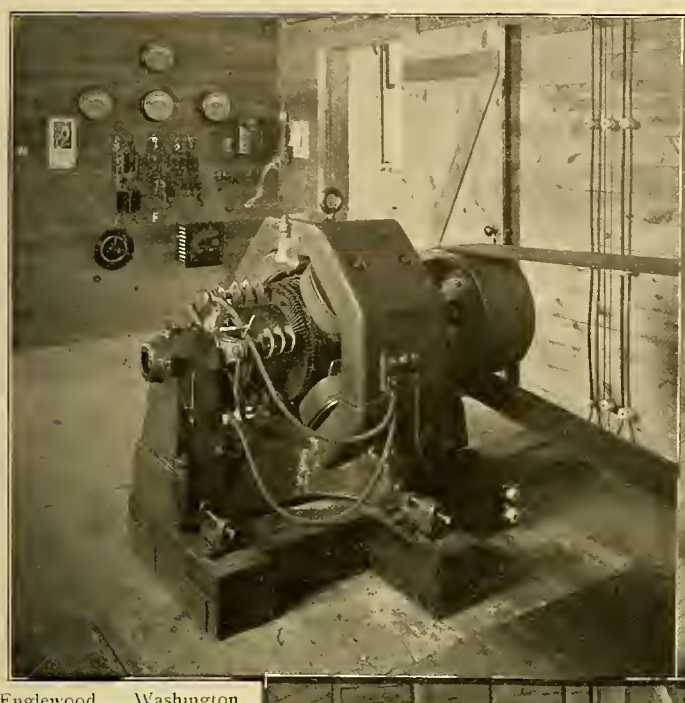


Fig. 3. Dynamo for Charging.

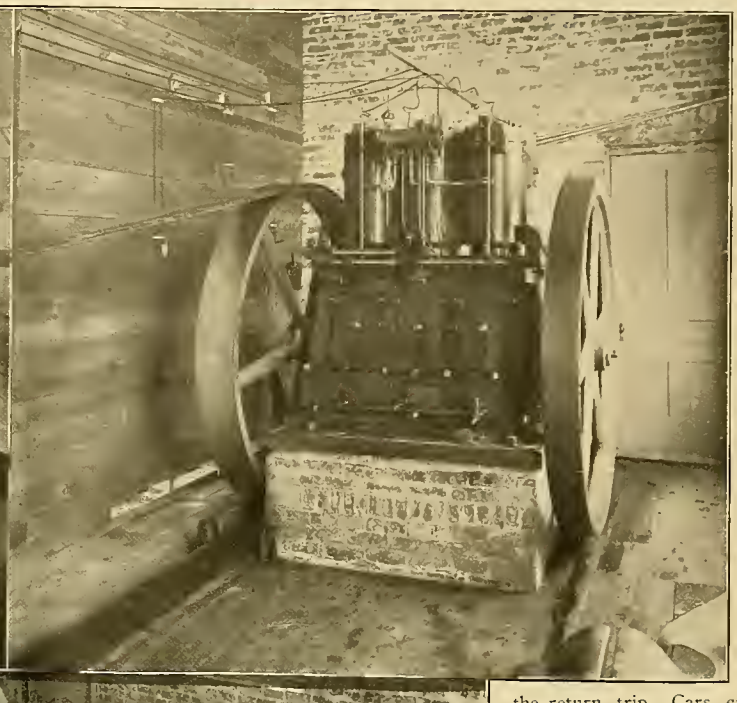


Fig. 2. Gas Engine Driving Dynamo.

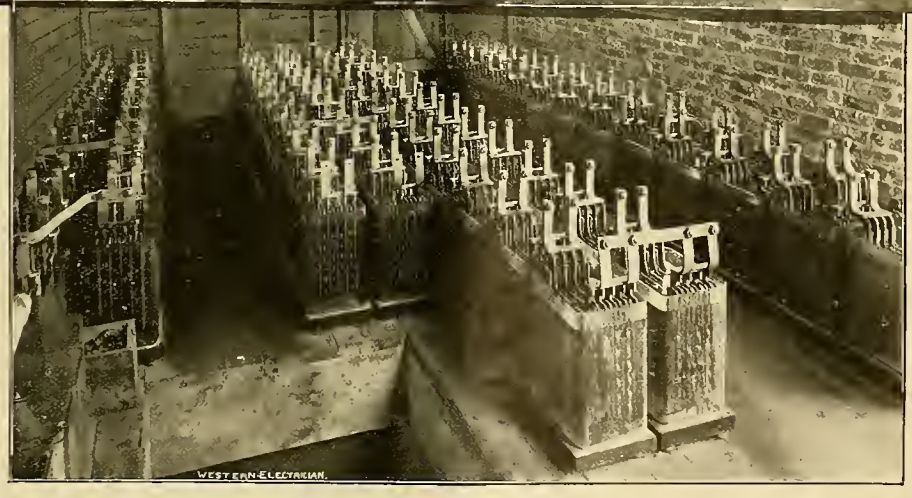


Fig. 4. Battery Room.

SUB-STATION FOR BATTERY CHARGING AT HARVEY, ILL.

The barns and main charging station, previously described at length in the Western Electrician, are located at Eighty-eighth street and Vincennes road, in South Englewood. All of the cars stop here and take on freshly charged batteries. After the extension to Harvey was opened up and as the traffic increased the company decided to erect an auxiliary charging station at the end of the line as a precautionary means in case of heavy demands on the batteries resulting from increased traffic or bad weather.

The station was completed recently and has been in regular operation since July 5th. Fig. 1 (p. 102) shows the front of the building, which is a brick structure, 26 by 70 feet in size, and divided longitudinally by a board partition. The western portion of the building is 10½ feet wide and is occupied by the car track. On the east side are the engine and dynamo room and the battery room.

Figs. 2 and 3 are illustrations respectively of the engine and the dynamo. The former is a three-cylinder, 50-horse power Nash gas engine, and was installed by the National Meter company of New York. It uses gasoline as a fuel, the gasoline being conveyed to the engine by means of a pipe from a tank placed in a small wooden building in the rear of the station. The dynamo is a 40-kilowatt, multipolar, shunt-wound, 200-volt machine, built by the Eddy Electric Manufacturing company, to run at 850 revolutions per minute. It is belted to the gas engine. Fig. 3 also shows the instruments placed on the wooden partition in front of the dynamo. There are three ammeters, the one on the right indicating the current of the generator, and the other two being connected to the battery in the next room. The voltmeter at the top indicates the voltage of the dynamo, which generally gives a current of 175 amperes at 160 volts. Other devices here installed comprise switches, rheostats and a Thomson recording wattmeter.

The battery room, illustrated in Fig. 4, contains 95 cells, only 81 being used at one time, however. Manchester plates, manufactured by the Electric Storage Battery company, are used. The battery equipment of each car is composed of 72 cells, having an aggregate capacity of 400 ampere-hours.

In the basement of the building is located the apparatus by means of which the loaded battery trays are removed from the cars. Directly beneath the car track is laid a track of light T-rails, on which two four-wheeled trucks run. In the center of this track is a Sprague electric sidewalk elevator. When a car reaches the station it stops over the elevator. The latter, with one of the battery trucks upon it, is run up under the car, receives the tray of batteries, and is then lowered. The truck is run off to one end of the track by hand and a tray of fully charged batteries is run up on the other truck and placed in position.

Charging terminals are placed at both ends of the short track, so that the battery can be readily charged before the arrival of the next car. Forty minutes is required to charge a car battery fully, but the Harvey station is only used to freshen up the batteries and not fully to charge them; therefore, as the cars are run on a 20-minute schedule, ample time is given between cars to put the cells in good condition for the return trip. Cars can be run from the central station to Harvey and back again without recharging, but it has been found advisable to have the batteries freshened up at the end of the road.

Fig. 5 shows the basement with a battery on one of the trucks about to be raised to the car above. The elevator is operated by a 30 horse power Sprague motor, which derives its power from the station battery. The plant is run 20 hours each day, starting at 5 a. m. and stopping at 1 a. m.

Electric Lighting of Gibraltar.

Like others of the British possessions, the Rock of Gibraltar has been supplied with electric light. The difficulties to be surmounted in its installation were unusual. The power station was built on the King's Bastion, one of the best sheltered points of the rocks, originally intended for the erection of artillery barracks, where every embrasure for the guns had to be blasted in the hard rocks. The different parts of the plant were placed in three steps, one above the other. At the bottom, almost on a level with the sea, is the boiler house, then comes the engine room, and the dynamos and switchboard are still higher up. The capacity of the works is 10,000 lamps of 16 candle power each. At present there are 500 lamps of different candle power in use for street lighting. Only the hospital and the government buildings are now illuminated, but later on the whole of the fortifications will be lighted by electricity. In addition, different parts of the fortifications are to be supplied with large electric searchlights.

Transformers; Iron Loss—Its Increase—The Remedy.[1]

By G. Wilbur Hubley.

Attention to the subject of transformers, meters, etc., in the alternating field of electrical work has been very general, and much has been written and many have been the discussions on these subjects.

The necessity of inspection, testing, etc., of all meters, in service at regular periods, has been conceded as an economic necessity by central stations, as well as being recommended by the manufacturers; yet such has not been true about transformers, and this important and essential apparatus has been most seriously neglected, owing to the impression and erroneously accepted fact that its characteristics

FIG. 1. SUB-STATION FOR BATTERY CHARGING AT HARVEY, ILL.

are, in a measure, unchangeable. The transformer passes into its work and no further attention is given, except in cases of absolute failure by "burn-out" or other extreme condition interfering with its service. It is, however, a generally accepted fact that there comes a time in the history of transformers when their efficiency and profit-earning can be greatly increased by means of substitution or change of characteristics. It is the latter plan that the writer shall treat as the subject-matter of this paper.

No other question has more commercial significance in the operation of a transformer system, from a central-station point of view, than the constant iron losses of transformers in service. Yet the question has had, probably, less careful and systematic investigation than any other detail of the alternating system, owing, doubtless, to the fact that the great and increasing losses in this direction have not been fully appreciated until within the past few years.

It must be admitted that great improvement has been made in this direction by the manufacturers, with a view of reducing this iron loss to its present low figure; but the question of "fatigue" is of greater importance than the initial conditions.

All data, tests, etc., as given in this paper, have been carefully and accurately compiled from actual facts and conditions, as they exist in the central station with which the writer is identified and of the company which he represents as delegate to this convention.

It has been found, in practice, that transformers having initially low iron losses (within limits of specifications), after being placed in service would show most decided increase—in most cases over 100 per cent. increase, and in exceptional cases as high as 300 to 400 per cent. increase, within very short periods of service under normal conditions.

In fact, the "fatigue" feature or large increase of iron losses in many transformers made their further use commercially prohibitive.

To illustrate the conditions of the question, the writer gives the following records of a few tests on various sizes of transformers, showing the increase of iron losses during periods of service:

Capacity.	Initial Test.		Second Test.		Per Cent. Increase.	Third Test.		Per Ct. Inc.	Total Per Ct. Inc.
	Watts.	Per Ct.	Watts.	Per Ct.		Watts.	Per Ct.		
500	36	7.2	65	13	80.6	75	15	15.4	108.4
1,000	58	5.8	75	7.5	29.3	100	10	33⅓	72.4
1,500	60	4	97	6.5	61⅔	120	8	23.7	100
2,000	75	3¾	125	6.1	66⅔	145	7¼	16	93.4
3,000	80	2⅔	133	4.4	66¼	150	5	12.8	87½
4,000	109	2.7	175	4¾	60.6	185	4.6	5.7	69.7
5,000	120	2.4	140	2.8	16⅔	145	2.5	3.6	20.8
7,500	145	1.9	167	2.2	15.1	190	2.6	13.8	31
10,000	190	1.9	250	2.5	31.6	....	....	.....	31.6
12,500	218	1.7	238	1.9	9.1	315	2.5	32.4	44.5
25,000	323	1.3	530	2.1	64.1	....	....	.....	64.1

The tests represent transformers of various types of manufacture during years of 1894, 1895 and 1896, and cover periods of service from 1894 to 1899. The actual service between tests varies from periods of six months to two years, but, in most cases, are tests made each consecutive year.

During the last few years the writer has carefully studied this question in its phases, as it relates to the practical conditions, as met with in every-day station work.

1. Read before the National Electric Light association at New York, May 24, 1899.

Only within the last year have manufacturers been willing to recognize or accept the adopted specifications on transformers of the central station; in fact, they would not guarantee initial limits or qualify limits of deterioration of their transformers in service. The writer adopted transformer specifications during the year of 1895, in which limits of iron loss were fully 50 per cent. greater than those of present-day specifications.

The following specification limits were adopted January 1, 1899, and all transformers must pass under initial conditions within specified limits, or be rejected:

Capacity.	Iron Loss.		Regulation Pr. Ct.	Capacity.	Iron Loss.		Regulation Pr. Ct.
	Watts.	Pr. Ct.			Watts.	Pr. Ct.	
500	35	7.00	3.00	6,250	125	2.00	2 00
600	36	6 00	3.00	7,500	150	2.00	2.00
1,000	45	4.50	3.00	10,000	175	1.75	2.00
1,250	45	3.60	3.00	12,500	200	1 60	2.00
1,500	51	3.40	3.00	15,000	210	1.40	2.00
2,000	60	3.00	3.00	18,750	225	1.20	2.00
2,500	65	2.60	2.50	20,000	240	1.20	2.00
3,000	75	2.50	2.50	25,000	275	1.10	2.00
3,750	90	2.40	2.50	30,000	300	1.00	2.00
4,000	90	2.25	2.50	37,500	375	1.00	2.00
5,000	110	2.20	2.25	50,000	500	1.00	2 00
6,000	120	2.00	2.25	.....	.....	.....	.....

Insulation test to be made by a series of make-and-break contacts, and one prolonged contact, as follows:

1. Between primary and secondary coils..... ....6,000 volts A. C.
2. Between primary coil and core.....6,000 volts A. C.
3. Between secondary coil and core.....1,000 volts A. C.

Temperature test measured by thermometers placed in mercury cups in core of transformers. Increase above surrounding atmosphere on full-load test of eight hours' duration must not exceed 60 degrees Centigrade.

Fatigue.—Iron loss must not exceed 10 per cent. increase above limits, as specified, within period of two years' service.

Overload.—Transformers must be guaranteed to stand overload of 25 per cent. above rated capacity, for duration of two hours, with temperature increase not to exceed 60 degrees Centigrade above surrounding atmosphere.

General Guarantee.—Transformers must be guaranteed for two years' service against burnout from any cause (including lightning), providing same are under normal conditions of service.

Remarks.—The above specifications do not contemplate the use of oil in transformers.

In case of failure of transformers furnished under specifications, all expenses of rejection shall be borne by the manufacturer.

It has been the practice of the writer to make initial tests on all transformers when received, and their acceptance or rejection has been strictly governed by limits as set forth in specifications; and to repeat this test under similar conditions as often as opportunity permits, i. e., at all times when transformers were brought into station from service.

A careful and permanent record of all such tests is kept, as they apply to each individual transformer.

during 300 days in the year: therefore, initially, the transformer will require during year "useful current" 1,500 kilowatts, and during year "iron-loss" current 508 kilowatts, or a total of 2,008 kilowatts for service.

It will be noted that "useful" current is 74.7 per cent., and "iron-loss" current 25.3 per cent., or "iron-loss" current amounts to 33.9 per cent. of current used "usefully."

Consider similar service and conditions on this transformer after "iron loss" has increased 72.4 per cent., and we find it will require during year "useful current" 1,500 kilowatts, and during year "iron-loss" current 876 kilowatts, or total of 2,376 kilowatts for service. It will be noted now that "useful" current is 63.1 per cent. and "iron-loss" current is 36.9 per cent., or "iron-loss" current amounts to 58.4 per cent. of current used "usefully."

The question naturally arose, "What was to be done with transformers having such abnormal iron loss?" it being out of the question to scrap these, or to obtain others by expensive method of exchange for new "present-day" transformers, under plan suggested by manufacturers, who willingly proposed to remedy this condition.

The writer began some experiments in line of treatment of iron of old transformers, and after some time obtained most successful and gratifying results in this direction. However, no claims can be made at present writing of the permanency or resultant action that may occur by the methods adopted, as only time test will determine this point; but it is reasonable to expect the changes made in the character of the iron in transformers so treated will prove itself more nearly constant and permanent than it was initially.

The method of treatment adopted is one of annealing the iron of transformers which show abnormal loss. The results have proven most gratifying, in all cases reducing the losses to their initial (or even better) records, and in no manner affecting other requisite qualifications of the transformer.

The work can be done readily, and at an admissible low cost per unit, to make the work commercially within bounds, and a far better paying investment than any other plan that has been suggested or followed with the same object in view. In other words, it restores the transformer system, whether transformers are new or old type, to their original, or even better, condition, as far as iron losses are concerned.

A table is herewith presented, compiled from records of experimental work on transformers taken from service, without selection, in the regular course of business of station. It therefore represents actual practical conditions. Some idiosyncracies are

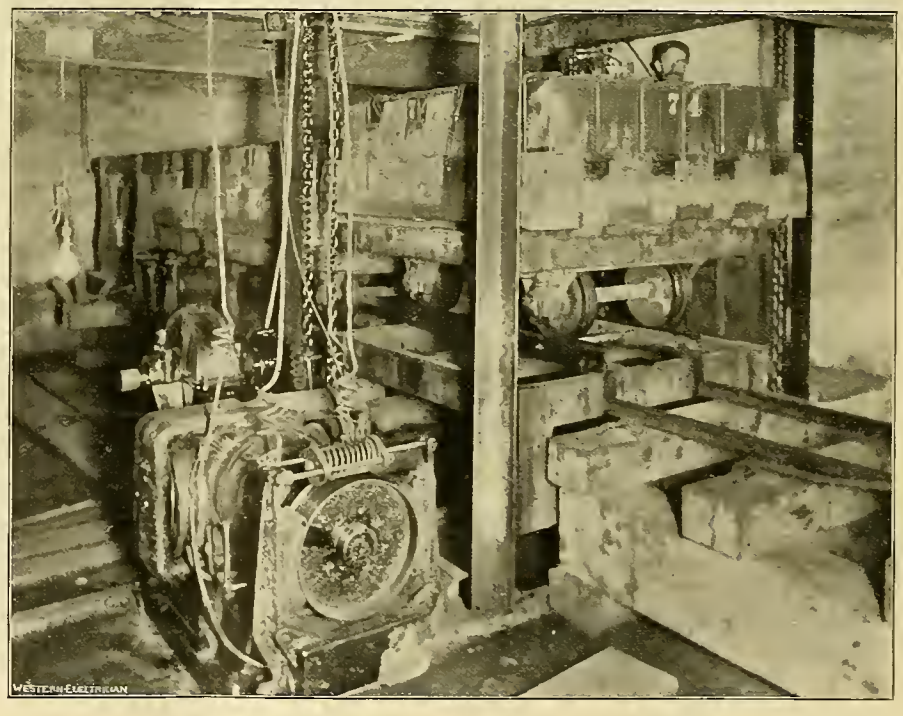


FIG. 5. SUB STATION FOR BATTERY CHARGING AT HARVEY, ILL.—BATTERY-TRUCK ELEVATOR.

It is probably unnecessary to state what the iron losses and their increase means to the average central station, except to call attention to the fact that existing iron losses in transformers approximate from 50 to 70 per cent. of output of the average alternating station.

Let us consider an average case by way of illustration, to compare the probable useful current supplied with the iron loss or waste current per year required at installation.

A 1,000-watt transformer having initial iron loss of 58 watts (5.8 per cent.), having been under service during a period of two years, records iron loss of 100 watts (10 per cent.), or fatigue of 72.4 per cent. We will make the liberal assumption that this transformer averages full load for five hours per day

shown that are interesting. From this table practically correct deductions may be made as to possibilities of reduction of constant iron losses, and the advantages to be derived therefrom:

Capacity Watts	Initial Test.		Test Before Treatment.		Increase Iron Loss, Per Cent.	Test After Treatment.		Decrease Iron Loss.		Kilowatts Saving, Per Year.
	Watts.	Per Ct.	Watts.	Per Ct.		Watts.	Per Ct.	Watts.	Per Ct	
500	40	8	64	12.8	60	42	8.46	22	34.37	192.7
1,000	60	6	88	8.8	46⅔	59	5.90	29	32.95	254 0
2,000	84	4.1	150	7.5	78.6	117	5.85	33	22.00	289.1
3,000	108	3.6	139	4.6	28.7	97	3.23	42	30.21	367.9
7,500	140	1 9	167	2.2	19.3	135	1.80	32	19.10	280.3
10,000	175	1¾	240	2.4	27.1	160	1.60	80	33.33	700.8
25,000	350	1.4	530	2.1	51.5	323	1.29	207	39.06	2,829.5

This table represents the average results of tests of transformers of capacities as noted.

Type, actual service of life of transformers, were not taken into consideration, as it is the object of the writer to present the actual practical working condition of the average central station. The station of which the writer is in charge has kept pace with the times in taking advantage of all improvements of modern apparatus, as well as modern methods of operation; and, moreover, gained decided advantage by complete change of all transformers to those of modern type, dating from the year 1894, when change was made from 1,000 to 2,000-volt system; and since such time has made one extensive substitution of about 50 per cent. of these transformers to others of latest type and manufacture. .

The cost of "annealing treatment," as practiced, can be accomplished at so low a cost per kilowatt that it insures its success. The plan to reduce and regulate the increased iron losses in transformers is both simple and practical.

The following data of detail costs per kilowatt capacity have been computed from records of actual costs during period of experimental work:

	Preparation.	Annealing.	Assembling.	Testing.	Total cost.
Av. cost per K. W.	.092	.106	.618	.084	.90

However, the above costs cannot be taken as criterion, as such only represent result of experimental work on transformers of various manufacture, type and capacity, and naturally these costs as given are considerably higher than will be found in practice. The average costs per unit will vary greatly under different local conditions, owing to the wide margin of variation of costs in transformers of small and large capacity, as the item of cost per unit does not vary proportionally with the capacity.

It can be liberally approximated that complete costs of "annealing treatment" will vary between 22 cents per kilowatt on 25 kilowatts size to $2.20 per kilowatt on one-half-kilowatt size of transformer.

The advantages of the "annealing treatment" of iron of transformers will be more fully appreciated by facts deduced from foregoing data, as set forth in the table given below.

It will be noted that the gains by actual saving to be obtained through adopted methods of treatment of iron, at the extremely low cost per unit, makes the system appeal for a place in the economic field of central-station operation more strongly than any other measure in this direction.

By the most conservative estimate the average central station can reduce and regulate within reasonable limits this all-important feature of loss wherever transformers are in service to 50 per cent. of their present records, and this means not only a saving of 25 to 30 per cent. on yearly cost of fuel, but increased capacity on boilers, engines, dynamos, etc. Hence the reduced fixed charges per unit, higher commercial efficiency of transformer system and consequent increased profits per unit of current sold; and last, but not least important, a periodical inspection, reinsulation and general renewal of all transformers in service, and an absolute control and regulation of their increase of iron losses.

Capacity Watts.	Loss Per Year, Kilowatts. Before Treatment.	Loss Per Year, Kilowatts. After Treatment.	Saving Per Year, Kilowatts.	Saving Per Year at 2c. Per K. W.	Estimate Complete Cost Treatment.	Interest Per Year Per Cent.
500	560 64	367.92	192.7	3 85	1.10	350
1,000	770.88	516.84	254.0	5.08	1.85	275
2.000	1.314.00	1,024.92	281 1	5.78	2.60	222
3,000	1,217.64	849 72	367.9	7-34	3 60	204
7.500	1.462.90	1.182 60	280 3	5.60	4.50	125
10.000	2.102.40	1.101 60	700.8	14.00	5 00	280
25.000	4.642.80	1.813.30	2.829.5	56.59	5.50	1.029

DISCUSSION.

H. L. Doherty, Madison: The writer tells everything but the one thing I am most interested in—whether the system is patented or secret. He lays great stress on the annealing. I do not think we can anneal the iron at a high enough temperature to have any effect on it without seriously interfering with the insulation. I noticed in testing transformers that the loss due to aging does not increase constantly. It increases on some transformers, and then goes back to the original loss. I do not suppose that the temperature was low enough to have an effect on the core.

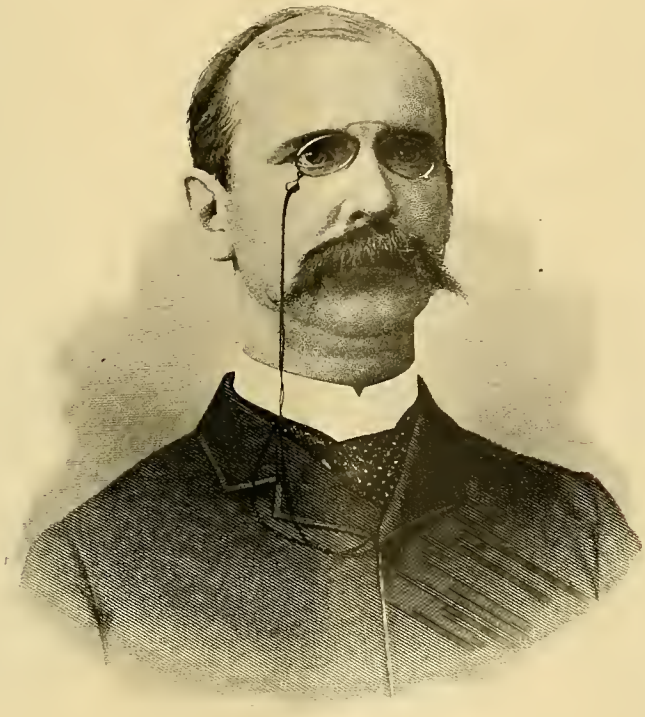
Mr. Hubley: The process is the simple annealing of iron. The transformer is taken apart and annealed in the ordinary way, and reassembled. We found the first results were unsatisfactory, due to the annealing not being uniform.

Mr. Doherty: At what temperature do you anneal?

Mr. Hubley: We have not taken the temperature, but judge of the annealing by drawing it to a cherry red. A particular point about the annealing process is to be sure that the iron is annealed. We tried annealing by electricity, but it was unsatisfactory, from the fact that it was not uniform, and in some places got hotter than others.

Power Development on Canadian Side at Niagara.

Electric energy developed at Niagara Falls is to be transmitted to Toronto for manufacturing and lighting purposes. The authority for this statement is Mr. Wallace Nesbitt, Q. C., Canadian counsel for the Canadian Niagara Falls Power company. Mr. Nesbitt visited Niagara Falls, N. Y., where he had been summoned to consult with Colonel Rankine, secretary of the company, and Professor George Forbes, F. R. S., of London, England, the distinguished electrical engineer. At the meeting of these gentlemen the question of the transmission of power to Toronto, Ont., was discussed, and it is understood that a decision favorable to the project was reached. Another company, in which Senator Cox of Toronto and Mr. James Ross of Montreal are interested, has also opened negotiations with the Ontario government for a franchise to develop power on the Canadian side of the Falls, but Mr. Nesbitt says that his company is not afraid of the issue, for it has the capital, it has the patents and it means business. The Ontario government has notified the Niagara Falls Park commissioners to inform the companies which at any time have made application for the privileges to generate power at the Falls that the monopoly clause in the Canadian Niagara company's contract has been canceled and the government is now open to negotiate.



GEORGE HENRY WHEELER.

Professor Forbes was consulting electrical engineer of the Niagara Falls (N. Y.) Power company during its construction period and advised it in regard to the adoption of its system for generating electricity and transmitting it for long distances. He spent eight months of last year in preparing plans for the development of water power at the second cataract of the Nile, visiting that country at the request of the British government, the power to be used for pumping for irrigation purposes and for long-distance transmission.

Electrical Activity in Germany.

H. E. Bandell, a copper dealer at Frankfort-on-the-Main, Germany, writes to the Engineering and Mining Journal to say that the consumption of copper in Germany is not decreasing. "In fact," he says, "consumption may this year even be somewhat larger than in 1898, since all works using copper are fully employed with orders, and some have made considerable enlargements. Electrical street railroads, electrical vicinal roads are being built now in Germany everywhere, and electric companies have yet considerable contracts on hand for building such roads; also the telephone system is continually enlarged, and cities and works are more and more lighted by electricity. In fact, so many contracts are out that consumption cannot decrease and may even increase for some time to come."

George Henry Wheeler.

Street-railway men will be saddened by the announcement that George Henry Wheeler, the president of the Chicago City Railway company from 1891 to 1898, and a director at the time of his death, died at the Hotel Champlain, near Plattsburg, N. Y., on August 11th. Mr. Wheeler had been in poor health for some time, and a fatal termination of his illness was not unexpected, but at the last death came quite suddenly. Mr. Wheeler was greatly affected by the death of Judge Grinnell, the late general counsel of the Chicago City Railway company, about a year ago, and was never a well man afterward. He suffered from a low fever, diagnosed as malaria. Later a stomach complication was developed and he was able to take but little nourishment. His system became debilitated, and when the end came death was sudden and the immediate cause was heart weakness. He was treated by several of the leading physicians of Chicago, and his removal to the Adirondack region was undertaken in the hope of benefiting his health. The body was brought to Chicago and the funeral took place from the Church of the Ascension on August 15th.

Mr. Wheeler was for years an active figure in the commercial and social life of Chicago. He was born at Laporte, Ind., on August 1, 1841. His father was Hiram Wheeler, a native of New Haven, Vt., and his mother was Julia Smith Wheeler, born in New York city. In 1832 the father of Mr. Wheeler removed from New York with his family to what was then considered the remote settlement at Laporte, where, nine years later, his son, George Henry Wheeler, was born. The next year the family removed to St. Joseph, Mich., where they made their home for eight years. Chicago was then a village, but the elder Wheeler, realizing its commercial possibilities, removed again with his family and made his home in Chicago in the year 1849.

George Henry Wheeler was educated in the public schools of Chicago and afterward went to Racine, Wis., where he took a course in college, and then returned to Chicago and engaged in business. In 1860 he entered the grain-elevator business with his father, and in 1867 he was admitted to partnership in the firm of Munger, Wheeler & Co., which at that time was one of the largest and wealthiest concerns engaged in the grain business in Chicago. He remained with this firm, actively employed in the management of its affairs, until 1889, when it was sold out to an English syndicate and he retired from active connection with the grain business.

Early in 1891 Mr. Wheeler was elected president of the Chicago City Railway company, and he remained at the head of that large corporation for seven years, being succeeded in 1898 by the late M. K. Bowen, who died last spring. During Mr. Wheeler's administration the company adopted electricity for the motive power on all its lines except the State street and Wabash avenue cable systems. Two large electric power houses were built, and the company now operates over 150 miles of electric railway. The traffic of the World's Fair year was handled successfully and proved very profitable. Mr. Wheeler was a capable business man, and with the able assistance of Mr. Bowen, one of the best street-railroad men in the country, in directing the operating department of the company, his administration was a success. After his retirement from the presidency, Mr. Wheeler was again called to the position in August of last year, when he was acting president for about a month in the absence of Mr. Bowen. After that, Mr. Wheeler did not engage in active business.

Mr. Wheeler was fond of horses and driving and was president of the Washington Park Club at the time of his death. He was prominent in the affairs of the Chicago Club and also a member of the Union League Club. During the World's Fair he was a director of the local company. He was a director of the Continental National Bank, one of the American trustees for the London Guaranty and Accident company and connected with several other business and social organizations. Mr. Wheeler was a widower, and two children—Mrs. Lawrence A. Young of Chicago and Henry Lord Wheeler, professor of Chemistry at Yale—survive him.

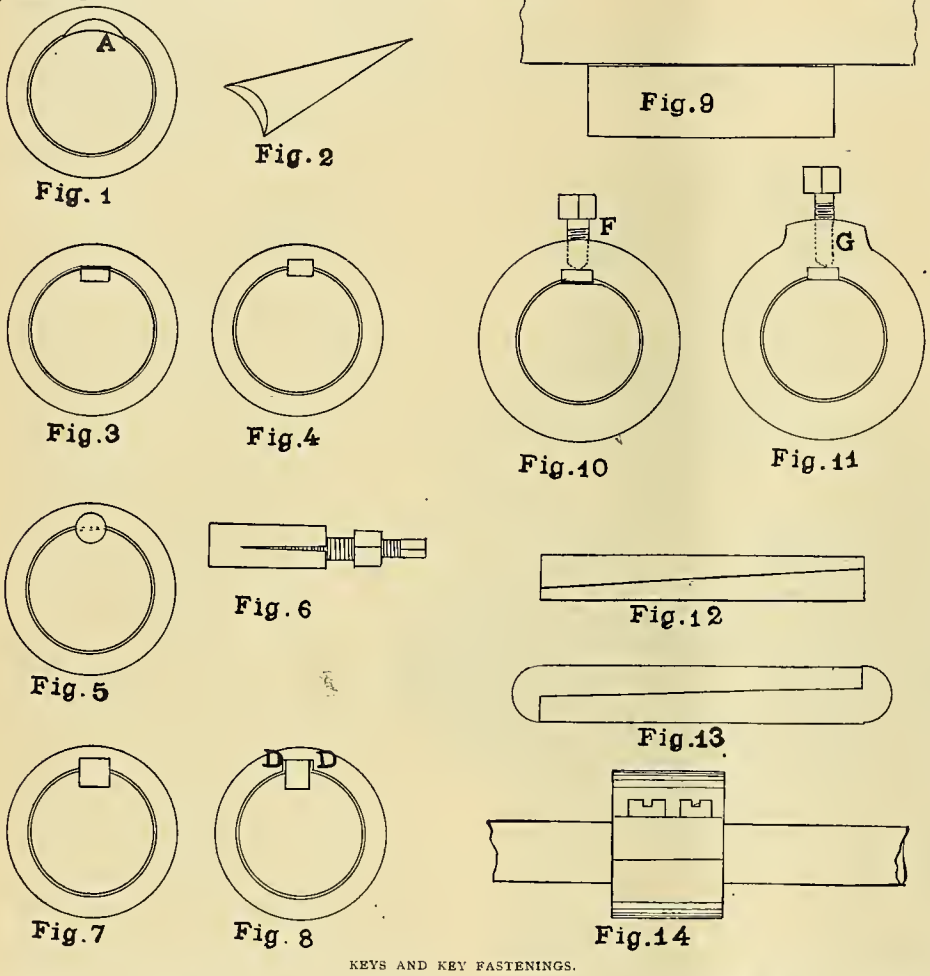
Thunderstorms in May.

During May, which is the latest month for which official statistics are available, 5,305 thunderstorms were reported by the United States Weather Bureau. In May, 1898, there were 2,871 of such storms, and in April, 1899, 1,962. The number reported in May, 1899, is remarkable. The dates on which the number of reports of thunderstorms for the whole country were most numerous were: May 29th, 411; 28th, 311; 31st, 309; 2d, 295. From Illinois 382 thunderstorms were reported; Ohio, 377; Missouri, 322; Iowa, 289; Michigan, 285.

Keys and Key Fastenings.

One of the subjects on which the electrical mechanic should be well informed is the keying of machine parts to shafts and spindles. A contributor sends the following practical suggestions:

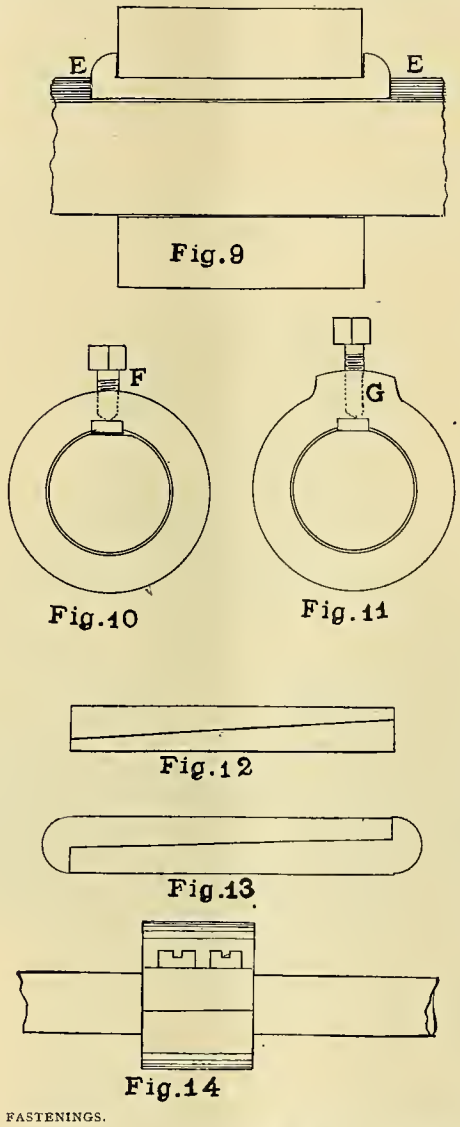
Methods of Fastening.—One of the worst kinds of fastening keys is shown in Figs. 1 and 2. This form of key is seldom used by manufacturers of electrical machines, but the writer has frequently found such keys employed as a makeshift on repair or alteration work performed by some electrical mechanic. The key is simply a piece of curved steel, reduced to a point, as shown in Fig. 2, and this point is started into a crudely rounded seat filed out of the collar with a round or half-round file, as shown in Fig. 1 at (A). The key is used because of its readiness of application. There is no need of cutting a key-seat in either shaft or the work to be fastened on the shaft. The key is usually driven home to the point of splitting the work, and for a time holds the work to the shaft firmly. But the vibration of the machinery eventually tends to loosen the beveled-shaped key and force it out. This key, though operating on one flat surface, cannot be classed with the regular flat keys or the square keys which hold by shearing strain. The type of key shown in Fig. 3 belongs to the flat-key class and acts on the diagonal-strut plan. It is suitable for general mechanical work in the electrical shop, providing it is correctly applied. This key is ordinarily made with the width about double the thickness and is calculated to be driven as a strut. This form of key requires that the sides be perfect in fit. The least deflection in the taper from trueness will frequently cause the key to spring and work out of position. When applied in the form shown in Fig. 3, in which the key-seat is cut only for the shaft, the connection is very likely to work loose, as the only means of holding the work is by frictional binding of the top of the key to the under surface of the work. Yet this design of key is sometimes used in this form, but often with the result that a new key is made and fitted into key-seats provided in both shaft and work, as shown in Fig. 4. A flat key applied in this manner is pretty sure to hold if put in tight and properly adjusted.



KEYS AND KEY FASTENINGS.

Troublesome Round Key.—The cheapness with which a round key-seat can be bored into the end of a shaft and work simultaneously tempts some machinists to use the round-key plan, as in Fig. 5. This key is usually a uniformly round steel pin, and when driven well into place will hold for a long time. But the mechanical action of the connections tends to loosen the round key sooner than the flat or square key. Some machinists partly overcome this trouble by tapping the seat with a thread and screwing the key into it with a corresponding thread. Others split the round key, after boring into it and tapping it with a thread, then provide an expanding set-screw, as represented in Fig. 6. With this form of key, the pin is first inserted, and then expanded by turning the screw.

Feather Key.—Feather keys are always practical for use in connection with electrical work. Fig. 7 shows this style of key, the section of which is square. The greatest trouble is in causing the key to bind wrong. These keys should not bind on the top and bottom of the key-seat and be loose at the sides, as at (D D), Fig. 8. This often happens, with the result that the parts loosen and rattle, if they do not wholly come off. A good driving fit is essential, and this is obtained by having the key so that it will bind well on the sides of the seat in both shaft and work, and barely touch at top and bottom. When this style of key is used in a sliding bearing, the plan is something like that in Fig. 9, in which the key-way in the shaft is marked (E E). In this case the key is made to slide easily in this key-way while it binds tightly to the hub or other work which is carried on the sliding bearing. The keys for this service must be perfectly true and planing may be advantageously used on the three sides next the seat.



When the Set-screw is Used.—There are certain parts of electrical machinery apparatus on which the ordinary forms of keys are not suitable, unless provisions are made for applying a tightening device. This is usually found by the use of the set-screw, applied in the form shown in Fig. 10. When the set-screw is used, it is usually because the conditions are such that the key must be removed frequently. In this case the ordinary flat key is used, a seat for which is cut in the work and a flat surface made on the shaft, so that the set-screw (F), Fig. 10, can be screwed down upon the key and hold it securely to the shaft. For light work this answers the purpose, but unless the collar, hub or other work is strong, the least excess of strain will split the metal at the point where it is weakened by the set-screw bore. To overcome this that part of the collar which receives the set-screw should be provided with a flange, as at (G), Fig. 11. This will strengthen the collar at that point and prevent its splitting when under strain from the set-screw.

Tapered Keys Driven in from Both Sides.—Electrical machinists can use the double form of tapered keys, as in Fig. 12, to good advantage, if both sides of the work can be reached, so as to drive from either side. The taper, of course, is varied to suit the conditions, but is usually about one-quarter of an inch to the foot. It is advisable to make the keys of the draw form, if possible, like the design in Fig. 13, in which each key is shaped with a draw-head or hook, by which the key may be drawn from its seat more readily.

Keyless Collars.—The condition may justify the use of keyless work on some occasions, in which case the work is simply bound frictionally to the shaft by the use of a collar and binding bolts, as shown in Fig. 14. The collars are split and the bore is a little smaller than that of the shaft, so that it is possible to bind the surfaces by tightening up on the cap screws; or the bore of the collar may be in excess of the diameter of the shaft, and padding used to aid in effecting a firm grip on the shaft. The strain to which these kinds of binding collars are put requires that brass or malleable-iron be used in their construction. If made of cast-iron, unless quite heavy, the pressure of the clamping bolts would probably fracture the metal.

The Motorman's Troubles.

[From the New York Tribune.]

"Well," said the new motorman, as he dropped into a chair beside a Tribune reporter last night, "I've been two weeks on the front of a trolley car, and I'm ready to agree with the writer of that editorial in yesterday's Tribune, where he says that the motorman on the surface car has the hardest time and deserves the best pay."

Then the new motorman paused while he read a letter from Delaware County, and after he had finished he began to tell of some of his experiences.

"I got so sick of the old town," said he, "that I made up my mind several weeks ago to get out and never go back. When the folks heard me say anything about leaving, they would say: 'We'll give you two weeks, and then Downsville will be good enough for you again.' That made me hot, and at last I got money enough together to buy a ticket to New York. That was just before the trolley strike, and as my application had been in several days, I had no trouble in getting a job. They sent me with about 50 others down to the Third avenue depot, and put me on what they call a school car. This car they use to break in new men on, and it's a sight to see the greenhorns do 'stunts' on it. They have it off the track about half the time, and burn out fuses three or four times a day. They have school cars of three or four kinds, and you've got to try your hand for a week altogether on all the cars before you get to the graduating car. It was pitiful to see some of the old men who applied try to get used to running those cars. I saw several over 50 years old, and I know from the way they acted they didn't have a cent. After a week of practicing some of them failed on the final examinations, and had to go away without work. The man who rides on the car doesn't know much about what the motorman has to go through before he's allowed to take out a car. It would take half a day to tell all about it.

"To wind up, they make you sit down with an inspector and answer—or try to—a lot of questions. These are fired at a man to see whether he remembers what has been told him. One of the examiners asked me what I'd do if the motor-controller handle should get stuck while the power was on full, so that I couldn't move it either way, and the rope on the trolley pole should break. I saw in a minute that the question was likely to be a knockout, and not knowng anything better to tell him, I said I'd get off the car and let it slide. The inspector just grinned, and said he guessed that would be the right thing to do.

"Do you know what putting it 'on the loop' means? No? I thought you didn't. Well, it's this. There are double motors under each car. The controller handle is worked on notches, from one up to seven, according to the make of the car. The last notch on the motor box is the 'loop.' Up to the last notch the power is all from one motor. When the last notch is put on, the second motor's power is brought into play. That's what makes that sudden lurch of the car just after it gets under headway, and makes you think you're going over a country-road 'thank ye ma'am.' As much power goes on with that last notch as was on all the other notches together.

"I could stand the hard work and irregular hours all right," continued the new motorman, "but kids and drunken men are nearly driving me to drink. On Monday night at dusk I was sailing down Hamilton avenue, feeling good, because I had not met with an accident all day. On a doorstep sat a man and his wife watching their little girl play with a rubber ball. The child threw the ball up, it bounded toward the car, and the little girl followed it. I was running at nearly full speed, and the child never saw me at all, although I was kicking the bell for fair. The mother gave a yell and fell back in the doorway, and the father put his hands over his eyes. Did I kill the kid? Not at all. I reversed the power and put on the brake so quick that I doubled six or eight people right over the backs of the seats in front of them. I just grazed the kid, but I suppose the people in the car will be suing for damages on account of shock to their systems. If I could get $10 for every shock to my system in the last two weeks I'd go back to Downsville wearing a $40 suit of clothes and patent leathers.

"If you bend the fender of your car or run over a dog or spill a washerwoman's basket of clothes

by starting too soon, or have a drunken 'bum' fall off the running board while you're waiting for him to get off, you've got to report it. The first four days I had pretty hard luck, and it took me three long hours every night to make out a duplicate accident report. On the fifth night when I appeared at the depot after my last run, the superintendent said with a grin: 'You'll find several hundred accident-report blanks right over there on the table.' You see, he got so used to hearing of something going wrong, that he didn't wait for an explanation. I didn't happen to need a report that night, and I was glad to tell him so.

"I haven't had a cent of money yet, although I'm on my second week. You have to put up $15 for a uniform before you begin work. The badge and cap and buttons cost $5 or $6 more, and then at the end of the first full week I was told that the company always held back a week's pay. If you go into a gin mill you're discharged. Mr. Rossiter is exceedingly strict about that. I don't know as you can blame him any. A drunken man would do awful work on the front of a trolley car. A sober man has it hard enough, but it would be a good deal worse if the man was groggy. If you're sick and cannot work, you're compelled to take three days off. This is so that a man won't report sick too often. He can't afford to do it, if he's going to lose three full days every time. It's a wonder more people are not killed. The schedule calls for running cars at nearly full speed between crossings. If you get blockaded the inspector reports you at once, and at the depot the superintendent can take

STREET ARC LAMP AT BOOTLE, ENGLAND.

explanations or not, just as he likes. As a rule, explanations don't go. If a man is late on his run he's likely to lose his job. I've been so homesick since I've been down here that on one or two nights I've sat on the bed and bellowed just like a big calf. I'd shake hands and take off my hat to a yellow dog this very minute if he came from Downsville, just for the sake of old times, and because he came from home. But I ain't going to give in. I couldn't stand the ridicule if I went back now, and I'm getting used to the 'kids' and 'drunks.' Most of my old friends in Delaware County are working for not more than $30 or $40 a month, and I'm making $14 and $16 a week. That will do me till I can get something better to do. I'm going to stick it out, but some days, after pretty near running over a 'kid' or a 'drunk,' I can't eat or sleep, and then it is that I wish I was back in Downsville, taking care of the cows and digging potatoes."

Central-station Statistics.

The latest edition of the American Electrical Directory gives statistics of 2,360 central-station plants owned by private individuals or corporations in the United States. These plants are owned by companies having a combined capital stock of $279,704,610, and employing 1,159,788 horse power in engines or water-wheels. The number of arc lights reported is 280,439, of which 250,230 are on series circuits, 21,043 on low-tension direct-current circuits and 9,166 on alternating-current circuits. The total number of incandescent lights is 8,060,364—2,679,432 direct and 5,380,932 alternating.

A Camera to Photograph Sounds.

In an article contributed to the Monthly Weather Review of the United States government, entitled "An Advance in Measuring and Photographing Sounds," Professor Benjamin F. Sharpe describes a camera to photograph sounds in which some very ingenious electrical applications are employed. The writer says that a musical note, which is some combination of pure tones whose frequencies bear a simple ratio, has to be analyzed into its component tones before the note is fully determined. "We might naturally suppose," he adds, "that a further distinction might be made based on the differences

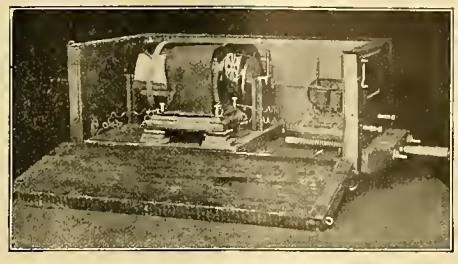


FIG. 1. A CAMERA TO PHOTOGRAPH SOUNDS.

of phase arrangement possible in a note, but it is found that the ear does not appreciate these differences, although the photographic instrument described makes them evident to the eye." Professor Sharpe then details the difficulties encountered in measuring sound and points out the necessity of producing, for the investigation, a pure tone of very great constancy in pitch and in intensity. This is done by vibrating a tuning fork and transmitting the motion to a thin iron plate. A constant tone is produced by driving the fork electrically by a constant current. The intensity of the tone will depend on the strength of the current, which can be regulated at will. Moreover, the intensity of the sound can be defined in terms of the current effective in producing it. In other words, the current can be calibrated in terms of the absolute intensities of the sound produced.

For photographing sounds a good electric arc lamp is required, because the time of exposure is extremely short. A single fixed lens focuses the interference bands upon the photographic film. This film is wound about a horizontal cylinder kept in constant and rapid rotation. A screen with the narrow horizontal slit is set as close as convenient to the film. If now the cylinder rotates, the image of the interference bands will be continuously printed on the film, the result being parallel bands with straight edges. But any sound added now will cause a vibration of the points of the strip sidewise, and the result will be a set of parallel, wavy bands.

The accompanying illustration (Fig. 1) shows the inside of the camera. The lid has been removed and the back let down. The cylinder is shown belted to a small motor, which is almost completely covered with a black cloth to prevent its sparking from fogging the film. But the pulley is shown, with black and white sectors upon its face. This is part of a stroboscopic device to observe and regulate the speed of the motor. Opposite this disk is a ruby-glass window in the camera for the purpose of viewing the disk. But this inspection is made between the tines of another tuning fork in vibration, as shown in Fig. 2. Two little screens

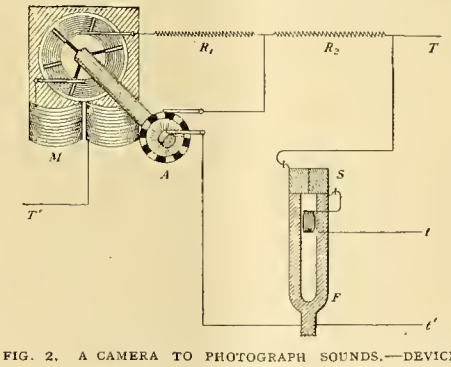


FIG. 2. A CAMERA TO PHOTOGRAPH SOUNDS.—DEVICE FOR REGULATING SPEED OF MOTOR.

(S) are fastened to the ends of the tines in such a way that they barely meet when the fork is still, but in vibration slide over each other without touching. Thus the view is interrupted once during each complete vibration. Now, if the disk turns just fast enough for one of the black sectors to advance to the position of the next, during the interval that the screens are closed, of course, the disk will appear to be at rest. This rate of motion is secured by feeding the motor with a constant current of just the right strength. This, again, is no easy matter, but a continental scientist, Lebedew, only a short time ago, devised a method of accomplishing it satisfactorily. His method consists in the arrangement shown in Fig. 2. The current through the motor enters at (T) and passes out at (T'). In so doing it passes constantly through the resistance (R_1) which is not quite large enough to slow down the motor as much as desired. (R_2) is a second resistance, which added to (R_1) would slow down the motor too much. But a shunt through the tuning fork cuts out (R_2) periodically; that is, for a portion of each fork period, thus bringing down the average resistance to the required amount; for the shunt circuit is regularly opened and closed at two places: at the upper platinum connection on the fork, and again at the accessory commutator (A) of the motor. If the shunt is closed at both places during the same interval, evidently (R_2) is shunted out during this interval, and the motor gains in speed. But if the connection is broken at one or the other of these two places during the entire period of a fork vibration, then the current must pass through both resistances (R_1) + (R_2), and the motor is slowed down. Accordingly, an automatic balance can be found between these two tendencies, by adjusting (R_1), (R_2) and the platinum contact, such as will give constantly the speed desired. The regulation is automatic, because the acceleration of the motor itself puts in more resistance and vice versa. The fork (F) is driven by an independent current, and is provided with a box having glass windows, as in the case of the fork of the object glass. By suitable pulleys, a speed of about three revolutions per second is given to the cylinder, and since the shutter slit is less than a half millimeter in vertical width, and the cylinder is 50 centimeters in circumference, it is evident that the time of exposure is less than one three-thousandth of a second; consequently, a very intense light is required.

But the time of exposure differs from the time that the shutter is open, for during this interval a series of pictures of the size of the shutter has to be made entirely around the cylinder, unless the operator wishes to waste his film by blank spaces or by overlapping pictures. It is, therefore, desirable to make the shutter open for precisely a third of a second at each exposure. This is done by the device represented in Fig. 3. The shutter (A) is at the end of a long lever, operated by an electro-

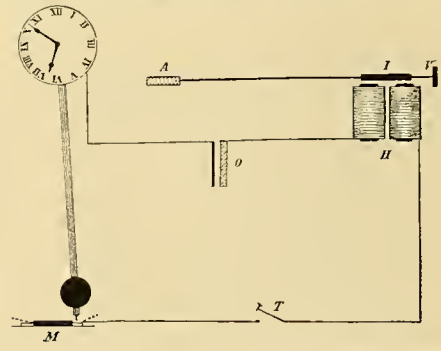


FIG. 3. A CAMERA TO PHOTOGRAPH SOUNDS.—DEVICE FOR OPENING THE SHUTTER.

magnet (H). The armature (I) has a hinge motion by means of the thin, flat spring (V), which is firmly clamped at the end represented toward the right-hand of the figure. The current from the battery (O) passes down the pendulum of the clock, which beats seconds, and around through the electromagnet, provided that the platinum point of the pendulum happens to be passing through the mercury (M), and provided, also, that the key (T) is closed. The width of (M) is adjusted so that the pendulum is in contact with it during about half of one swing; then, to make an exposure, the key is closed at the beginning of a swing in either direction, taking care to open the key when the swing is completed. This is best done by having the clock where it can be seen. The ticking is no disturbance, for it dies away before the shutter is opened.

Street Arc Lamp at Bootle, England.

Bootle is a town of about 50,000 inhabitants in the North of England. The corporation of the town has just erected a 220-volt electric-light plant of 300 kilowatts capacity in three dynamo units. One feature is a balancing transformer, consisting of two balancing armatures directly connected and working in separate fields. This is connected across the outer mains of the three-wire system at the switchboard bus-bars and also connected to the center wire. It is capable of balancing the whole system, so that with a current of 100 amperes in the center wire, in either direction, the difference of electromotive force at feeding points between the two sides of the system shall not exceed four volts. Directly connected to the balancing transformer, one at either end, are two battery-charging transformers or "boosters," each capable of an output of 130 amperes at 75 volts, and arranged to give any electromotive force from 10 to 75 volts on open circuit, and capable of running with any current from 0 to 130 amperes at any voltage between the limits mentioned.

For street lighting 10-ampere arc lamps will be used, many of the poles also having brackets for two 16 candle power incandescent lamps to be switched in at midnight, when the arcs are turned off. A handsome street lamp, surmounting a drinking fountain is shown in the illustration, reproduced from the London Electrical Review.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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HIGH WATER MARK

CIRCULATION, 20,000.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

Society for the Promotion of Engineering Education, Columbus, O., August 17th to 19th.

American Association for the Advancement of Science, Columbus, O., August 21st to 25th.

International Meteorological committee, St. Petersburg, August 25th.

New York State Electrical Contractors' association, Buffalo, N. Y., August 29th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

Pennsylvania Street Railway association, Stevens House, Lancaster, Pa., October 3th and 5th.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

A coroner's jury in Omaha has placed the blame for the recent fatal accident at a fire in Omaha on the local electric-light company and the city electrician, charging criminal negligence. An extension ladder was used at the fire and the ironwork of it came in contact with an unprotected wire forming one side of a 2,000-volt alternating-current primary circuit. A direct ground through the ladder was established. Six firemen were standing in mud and water at the bottom of the ladder operating the windlass and four of them were killed. The men were doing their duty manfully, and their death was very sudden and very sad. Public opinion in Omaha was greatly stirred up by the affair, which may result in the burial of all high-potential wires in that city, aside from any results growing out of the presentment of the coroner's jury. On the newspaper statement, it looks as though the construction work of the electric-light company and the inspection of the city authorities were defective, and a severe penalty may be imposed.

What a wonderful thing is "the production of five horse power from two without additional cost"! The boy who attempted to lift himself by his bootstraps isn't in the same class with the corporation that proposes to put two horse power into a machine and take five out, for he should have handicapped himself with an additional burden of half his weight on his shoulders. However, liquid air is to do the trick, and the Liquid Air Power and Automobile company of Boston is to superintend the operation—that is, when it gets through offering its stock for sale to the public, which is its occupation just at present.

In offering its stock at the modest price of $2.50 a share when the par value is $10, the company naturally tells something about liquid air and about itself in advertisements inserted in the daily newspapers. It seems—that liquid air is destined to take the place of all other forms of motive power—steam, electricity, compressed air, gasoline, etc., etc.—is an inevitable conclusion from the latest developments in the use of this most marvelous force ever discovered. In effectiveness, economy, lightness, safety and cleanliness it so far surpasses all other powers that no other result is possible than their final disuse, and in 10 years from now they will have been relegated to the company of the stagecoach and canal-boat of our forefathers." Indeed, "from Faraday's first success in liquefying gas to the harnessing of liquid air as the universal motive power is a long step, but no greater than the progress from Watt's tea-kettle to the magnificent steam engines of the present, or from Franklin's kite and key to Morse's telegraph, Edison's light and Bell's telephone."

The company itself is almost appalled by the possibilities within its grasp. "Not only have these men [certain liquid-air inventors who are named] devised the means of controlling the power of liquid air to the use of man, but through their ingenuity have been devised the means of more than doubling its effectiveness, for they have made possible the production of five horse power from two without additional cost. We are perfectly aware that this statement challenges belief, but the incredulous are simply invited to test it by calling at our offices and examining for themselves, in any way they desire, the mechanism which produces this result. We have no mystery of the spheres, no secret process, but substantial machinery, covered by United States patents, and as plainly demonstrated in practice as the dynamo, the telephone and the air brake." As is truthfully said, "It seems incredible that power in any desired quantity, a power that will within a few years, if not months, become of universal use, can be secured from the earth's atmosphere, almost without cost; but that it can be done, and in fact is already done, is a fact demonstrated beyond question by the inventions owned by this company."

Of course, the company holds the key to millions in profits, and the investing public is invited to provide "additional working capital" at the trifling price of $2.50 a share, although "the stock will undoubtedly become the most valuable holding known to the world of investment."

These quotations are not imaginary; they are not the dreams of alchemy; they do not date back 180 years to the time of the South Sea Bubble. They are taken from actual advertisements in last Sunday's Chicago and New York papers. The names of the officers of the company are given, the address of the place of business, the name of the bank which is the depository. And people are calmly asked to contribute their money to back the "inventions" of those who "have made possible the production of five horse power from two without additional cost"!

Some curious facts were brought to light last week by the coroner's inquest (still unfinished at this writing) into the frightful trolley-car accident of August 6th near Bridgeport, Conn., reported in the last issue of the Western Electrician. The motorman swore that he had been continuously at work all day with no opportunity to take food. The accident occurred in the middle of the afternoon. The witness should have been relieved at 2:40 p. m., but the man who should have taken his place was late, and as the company appears to have provided no substitutes, the motorman, Hamilton, was compelled to take the car out for the fatal trip. Going down the incline to the bridge, the motorman testified, the current was off and the brakes partly set. The car did not run 15 feet on the bridge before jumping the track. The witness immediately attempted to reverse the power, but found he could not do so, the motor refusing to reverse. When he found that the power was of no use the witness said he immediately grasped the brake handle and did his utmost to stop the progress of the car. He had almost succeeded in bringing it to a full stop when it began to topple. He then dived off the front and over the dasher, striking on his head on the bridge. Hamilton said that he was confident that had the power worked all right he could have stopped the car.

G. B. Underwood of New Haven, an electrician, at the request of Coroner Doten, examined the contact box of the controller on the front end of the wrecked car. Mr. Underwood testified that he found the door of the contact box partly opened. The condition of the box indicated that it had been opened with a screw-driver, or a similar implement, as the bolts all were unbroken and in place, which hardly would be the case had the fall from the bridge broken the box, thus causing it to open. An examination of the interior of the box disclosed the fact that some of the contact fingers were missing, rendering the reverse lever useless. In every other way the box was in good condition. The power was turned completely off, but there was no evidence that the power had been reversed. The witness said that only two or three were left out of a total of 27 of the fingers of the controller. Some had been freshly broken off, but the majority had been removed by means of a screw-driver. It was possible that those broken ones might have been broken by the fall of the car, but, in his opinion, that was not likely. He was then asked if there was anything about the car to indicate that it could not have been stopped in time to avert the catastrophe. He replied: "No; I think there was time to stop the car after it left the rails. The time was short, to be sure, but there was time enough to stop it either by the use of the reverse lever or the brake. Of course, if the derailment had jolted the trolley pole from the wire, the reverse lever would have been ineffective, as there would have been no current."

Other witnesses testified that on the day after the accident, but before the coroner's jury visited the scene, a large number of men were engaged in filling-in and tamping with dirt the ties under the rails at the south end of the bridge.

The facts that the motorman was sent out on a trip that, if completed, would have compelled him to work 11 hours without food; that the controller appeared to have been tampered with, and that an effort was made to patch up the roadbed at the approach to the bridge before the jury could see its real condition, have an ugly look. The accident caused 29 human beings to lose their lives. If it was due to preventable means it will remain an appalling blot in the history of electric-railway operation. The investigation should be most thorough and searching, and no person or persons guilty of negligence should escape the severest penalty of the law. And let all electric-railway men see to it that their employes, their apparatus, their schedules are such as throw the greatest possible protection around human life. The legitimate advantages of electrical operation should not be shadowed by such terrible accidents as the one at Bridgeport.

Removal of Overhead Wires in Boston.

The report of Mr. Flood, the wire commissioner of Boston, for the year ended January 31st last, contains a review of the work accomplished since the office of wire commissioner was established in 1894. By legislation the burial of overhead wires was limited to the portions of Boston north of Dover and Berkeley streets, and between Charles River, the harbor and Fort Point Channel, and the time limit was January 1, 1900. So much extra work has been done that the prescribed district is now completed. Commissioner Flood in his report says:

"The underground conduit system for the overhead wires is now completed in the prescribed district, but the extended use of electrical energy compels some of the electrical companies to add to their existing conduit systems, while there are some who have had no overhead wires at any time now engaged in building conduits.

"With the close of the present year all wires not exempt by law will disappear from over the surface of the streets within the prescribed district.

"But two classes are exempt—long-distance telephone and street-railway trolley wires. Exhaustive experiments are being made to overcome the electrical difficulties in the transmission of speech over long-distance cables, and considerable success has been attained, and the time may be not far distant when the long-distance telephone wires can be placed underground.

"The removal of the overhead trolley wires from above the surface of the street seems to be as remote as ever, owing to reasons other than electrical. The act of 1894 did not, and the act of 1898 will not, compel the removal of the overhead trolley wires.

"The removal of the overhead wires for the 10 years beginning January 1, 1900, will not be confined to any particular section of the city, but in such streets and avenues as in the judgment of the commissioner of wires contain poles and wires that are unsafe and a serious obstruction in case of fire. There is no doubt that a large amount of overhead wire will be placed underground in sections of the city other than that prescribed by the Wire Department.

"While the 1898 district contained fewer overhead wires than any other section of the prescribed underground district, yet there were more conduits built and more cable drawn into the same than was done in any one year since the organization of the Wire Department, most of which was done by the Boston Electric Light company and the New England Telephone and Telegraph company.

"Dead and abandoned wires are still the cause of much trouble in the portions of the city outside the underground district; like the poor, they are always with us, but, unlike them, they are extremely dangerous. The practice of placing high and low-tension wires on the same poles and fixtures is extremely dangerous and should be discontinued.

"The number of poles, fixtures and overhead wires removed since the Wire Department was organized is as follows:

Poles removed	2,041
Fixtures of all kinds	12,891
Wire on poles removed (feet)	2,350,050
Wire on fixtures (feet)	12,417,650
Wire in cables (feet)	13,845,872
Wire dropping from roofs (feet)	1,562,166
Railroad feed wires (feet)	288,722
Railroad guard and span wires (feet)	340,410
Total amount of wire removed	30,813,838

"This is about 5,836 miles. Of this amount 18,488,300 feet, or about 3,502 miles, can be classed as 'dead' and abandoned wire, some of which was removed by the owners, but nearly all was removed by this department.

"The interior division examined 565,135 incandescent lamps, 11,644 arc lamps, 4,104 electric motors, with a total of 17,074½ horse power. The number of defects discovered by the inspectors and caused to be corrected was 18,984.

"The number of men in this division is not sufficient to perform all the duties imposed on it by the acts of the Legislature, and as a result some of the most important work must be left undone.

"The reinspection of electric equipments is as necessary as the first inspection. Many of the wires and appliances in many of the best dwellings, for instance, may be, and probably are, in an unsafe condition. It is the duty of this division to know the exact conditions and have proper remedies applied before fire or loss of life results from causes that are preventable, but at present that duty must be honored in the breach and not in the performance.

"The necessity for a better class of wormen employed in electrical construction grows greater every year, and the employment of incompetent men and so-called 'electricians' adds greatly to the labors of this division. Gas-fitters and plumbers must obtain a license before pursuing their calling, and it is just as necessary that electrical workers should be compelled to do the same

"Following is the underground work:

Feet of conduit	726 997
Feet of duct	3,469.011
Feet of cable	5,427,482
Feet of single conductor in cables	167,751,793
Number of service connections	7,313
Number of manholes	4 563
Number feet of Edison tube	395,909
Number feet of single conductor in same	1 442.339
Number of distribution boxes	374

"With the exception of laying submarine conduits at the L and Congress street bridges by the Boston Electric Light company, and one at Warren bridge by the New England Telephone and Telegraph company, for the protection of their lead-covered cables, there has been no deviation from the original underground plans.

"The total rated horse power of boilers in use for the production of electrical energy in the city of Boston is 90,382; of engines, 66,774; total capacity of dynamos in incandescent lamps, 424,443; in arc lamps, 13,094; number of electric motors in operation, 7,070; total horse power of motors, 84,002; number of generating stations, 29; number of isolated or private plants, 195."

Resolutions for Mr. Yerkes.

Charles T. Yerkes, who recently resigned the presidency of the North Chicago Street Railroad company and the West Chicago Street Railroad company, was the recipient on August 10th of a set of engrossed resolutions and a farewell address at the hands of a committee of 10, representing all of the employes of the West Chicago Street Railroad company. The address was in response to the farewell delivered by Mr. Yerkes at the time of his withdrawal from the management of the West and North Division companies some time ago. This interesting testimonial, which was neatly framed in oak, read as follows:

Memorial address to Charles T. Yerkes, from the employes of the West Chicago Street Railroad company. Chicago, Ill., July 15, 1899. Mr. Charles T. Yerkes—Dear Sir: With the feelings of the profoundest regret, we have read your letter announcing the severance of your connection with the West Chicago Street Railroad company, and at a meeting held July 15, 1899, it was unanimously resolved that we take this early opportunity of expressing our regret, and also assuring you of our hearty appreciation, both individually and collectively:

1. Of your wise and efficient management, even under the fire of unmerited public censure.

2. Of the faithfulness with which you have kept the pledges given at the beginning of your administration, maintaining them, as you have, through fluctuating money markets and desperately hard times.

3. Of your successful work along the line of street-railway extension, which, in its far-reaching influence, is, perhaps, one of the greatest benefits ever realized by the city of Chicago and its suburbs, and which will increase with the coming years.

4. Of your strict justice and your many acts of generosity of which the world has not known, and, above all, your personal interest in the men themselves. We thank you for your words of commendation. We are proud of the fact that each man's work however humble and insignificant it may seem, is considered by you a necessary and important part of the mighty whole.

In conclusion, we wish to assure you that we will give to the new management the same loyal service which we have given to you during your administration of the affairs of the company.

Bespeaking for you all the great and good gifts that a beneficent Providence can bestow, continued prosperity and a long life crowned with health and happiness, we remain,

The employes of the West Chicago Street Railroad company.

Electrical Trolley Riders.

The '99 trolley party of the Chicago Electrical association was an unqualified success. It was given on the evening of August 10th over the tracks of the Calumet Electric Street Railway company, in the southern suburbs of the city. Over 100 ladies and gentlemen were members of the merry assemblage, and every one of them had a good time. There were three open cars, brilliantly decorated with incandescent lamps, and a start was made from Sixty-third street and South Park avenue about eight o'clock. The route was over the company's lines to West Pullman, where a stop was made for dancing and refreshments. Returning, a second intermission was made at a pavilion on the lake shore, where there was more dancing. The day had been oppressively warm, but the evening air was just what it should be for a trolley ride, and the outing proved a delightful one. The committee in charge of the affair consisted of Messrs. J. G. McMeen, J. R. Cravath and V. R. Lansingh, and their work was successfully supplemented by Mr. T. G. Grier, the president of the association, and Mr. W. A. Harding, the master mechanic and electrician of the Calumet company, both of whom were indefatigable in their efforts to further the enjoyment of all. Others present were Mr. A. R. Abbott, a trustee of the Illinois University; Mr. Joseph Kipley and Mr. Lyman Lewis, general superintendent and assistant general superintendent of the Chicago police, and Lieutenant F. B. Badt.

Firemen Killed by Electrical Shock.

A heavy ground on a 2,000-volt primary circuit of the Thomson-Houston Electric Light company caused the death of four firemen and serious injury to two others at Omaha on the evening of August 9th. The men were in the act of lowering a long extension ladder from the side of a building in which a fire had been extinguished. The ladder came in contact with a wire, the current following the iron-work of the ladder down to the cranks of the windlass, through the bodies of the six men that were operating the windlass, thence through the mud and water in which they were standing into the ground. All six men were rendered unconscious by the shock. Two of them recovered in a short time and will probably live. Three of the firemen never recovered consciousness. One man, after being revived, remarked that he was all right, and, in defiance of the advice of the physician to lie still and rest, got on his feet and started to walk away from the building, falling dead after he had proceeded about 25 yards.

An Omaha correspondent of the Western Electrician, commenting on this unfortunate occurrence, says that public opinion at present is undoubtedly in favor of compelling the placing of all electrical conductors underground in Omaha.

The coroner's jury placed the blame for the death of the four firemen on the Thomson-Houston Electric Light company and the city electrician, charging criminal negligence.

Electric Clocks.

At a recent meeting of the electrical section of the Franklin Institute Mr. James Hamblet, manager of the telegraphic-time service of the Western Union Telegraph company at New York, presented a communication on "Electric Clocks, Historically Considered, and the Uniform Distribution of Time." In effect, Mr. Hamblet said:

Electric clocks were first invented in England, by Alexander Bain and Sir Charles Wheatstone, about the year 1840 or 1841. Mr. Bain's clock consisted of a pendulum with a bob made of a hollow coil of wire, through which current from the earth passed, which, at regular intervals, caused the pendulum to vibrate. Mr. Bain first used an earth battery for electric clocks. In his original patent he described a method of propelling the pendulum by an apparatus at the suspension of the pendulum, doing without the coils. In another plan he had coils fixed to the side of the case and steel magnets in the bob of the pendulum; in this plan he did not have to convey wires through the pendulum rod.

Sir Charles Wheatstone used magneto-electric currents to propel the hands of a clock, and Mr. Bain also mentions the same idea, but did not utilize it. A Mr. Shepard, in England, made electric clocks about the year 1849, and announced that he was going to run all the clocks in the exposition in 1851. He did not succeed in doing this, however.

The first inventor on this side of the water was Mr. Moses G. Farmer, the celebrated inventor of the telegraphic fire-alarm system. The next inventor was Albert Hall of Ohio, in 1854, after which Mr. Farmer made some improvements in his first clock.

In 1860 the electric watch-clock for registering the duties of watchmen during the night was invented by Mr. Hamblet, some of which are still in use in Philadelphia. In 1864 Mr. Hamblet invented the first electric pendulum, a model of which was exhibited to the audience. The lecturer described a number of ingenious pendulums made by Hipp of Neuchatel, Switzerland.

In the matter of the distribution of time in this country, the standard of time was adopted by railway companies in October or November, 1883.

Previous to the adoption of a standard system of time there were over 80 standards of time throughout the United States. In the state of Ohio alone there were eight different standards. Now there is only one standard of time in the whole country, differing only by even hours, and the time is sent daily from Washington to the entire country, so that the whole question is simplified.

The Western Union Telegraph company distributes the time from Maine to California. In New York there are something like 1,500 self-winding clocks, corrected every hour by the standard clock of New York. In New York city there are 23 wires all over that city, extending from Western Union building, 195 Broadway. The standard clock sends out its beats over the city every two seconds, beating the even seconds, zero, 2, 4, etc., omitting the 58th second every minute, thus making a pause at the beginning of each minute. Every fifth minute 20 seconds are omitted.

Many of the prominent jewelers (nearly 200 in number) have sounders which tick every two seconds, thus having the advantage of one standard clock for the whole city. The machinery of this standard clock was thrown upon the screen in the form of a lantern slide, and explained very thoroughly to the audience. The clock acts upon the 23 wires by means of 23 sounders, located near the clock in the time-service room, and at each hour the standard clock sends a strong synchronous current to the whole 1,500 clocks in the city.

The self-winding clock was also exhibited. This clock is wound by electricity every hour, and does not require any attention, except when it needs oiling or renewing of battery, which occurs about once in every three or four years.

Electrical Storms.

A number of severe electrical storms visited different sections of the country between August 3d and 11th. Much damage was done by the wind and rain, and the lightning was the direct cause of several fatalities and the loss of valuable property. Philadelphia suffered a loss of over $1,000,000 from fires caused by lightning and floods resulting from the very heavy rainfall. Other places in Pennsylvania that reported heavy losses were Williamsport, Bloomsburg, Connellsville, Bedford, Wilkesbarre and Butler. Sections of Maryland and New Jersey were also visited by heavy storms, and several persons are reported as having received severe shocks, some of which were fatal. New York came in for its share of loss of life and property, reports from different parts of the state indicating that the storm was an unusually severe one. The West also suffered from the effects of the storms, the greatest losses resulting from the destruction of crops. Chicago, on two successive evenings, was swept by severe electrical storms, no serious accidents being reported, however. A trolley car near Highwood made a wild run for half a mile on account of lightning striking the car and stunning the motorman. The latter lost control of the car, but it was brought to rest without causing any serious damage.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Rates in Germany.

In a review of the trade and commerce of Frankfort-on-Main and district for 1898, Sir C. Oppenheimer, the British consul-general for the district, reports that a proposal for a reduction of telephone fees is before the Imperial Diet. On January 1, 1898, the total number of telephone subscribers on the government telephone circuits was 123,091, with 149,664 telephone stations, exclusive of those in Wurtemburg and Bavaria, which states possess their own telegraph and telephone services. The telephone subscription, outside Wurtemburg, is 150 marks ($36) per annum, the Wurtemburg subscription being considerably lower. The proposal at present before the Imperial Diet is for the breaking up of the subscription into two parts—an annual rental and a fee for each conversation. The principal fee is to be in circuits up to 1,000 subscribers, 60 marks; in circuits from 1,000 to 5,000, 75 marks; from 5,000 to 20,000, 90 marks; with more than 20,000, 100 marks. The connecting point must not be more distant than five kilometers (about three miles) from the central office. In addition to this chief fee is added an additional one for connections, which is to be calculated upon the average connections which take place during the year made by each subscriber, i. e., all conversations at one single place are added together and are divided by the number of subscribers. The average number thus obtained gives the number of conversations, on the basis of which the calculation is to be made. The tax per conversation is to be 20 marks for the first 500 conversations; from 500 to 1,500, for each 500, 30 marks; from 1,500 to 3,000, for each 500, 20 marks, and for more than 3,000, 10 marks. Each series of 500 conversations is reckoned fully. The telephone fee would accordingly be from 80 to 190 marks. Thus partially a reduction, partially an increase, would be brought about.

Provision is made for paying according to the conversations that actually take place, when the first 400 conversations would have to be paid for at 20 marks; further conversations with 5 pf. (1.2 cents) each, when each 100 would be counted fully. These charges are meant for local intercourse; for long-distance telephones, different proposals are made: Each conversation of not over three minutes, at a distance of up to 25 kilometers, inclusive, 25 pf.; up to 100 kilometers, 50 pf.; up to 500 kiloweters, one mark; up to 1,000 kilometers, one mark 50 pf., and over 1,000 kilometers, two marks. The highest fee payable up to now has been one mark. But now the telephone-exchange system is to be admitted throughout the empire. Whether this proposal will be accepted by the Imperial Diet is uncertain, as there is much opposition to the method of calculation proposed. In connection with this law is the bill by which privilege is to be granted to the telegraph authorities of the empire to make use of public ways, roads, squares and bridges or rivers, as well as the banks of rivers, inclusive of the open air and earth, for their telegraph wires, so far as traffic is not thereby molested. Telegraph lines are here to be put on an equal footing with telephone wires.

From the Old Bay State.

[Boston correspondence of the Western Electrician.]

The Massachusetts Telephone and Telegraph company, the Bell company's new rival in this section, has purchased 150 miles of pole and wire service from the Western Union Telegraph company, thereby obtaining connection from Boston with Providence, Worcester, Taunton and other points in which its new exchanges will be established.

By its recent acquirement of the Southern Massachusetts Telephone company the New England Telephone and Telegraph company, which is a subordinate of the Bell company, added about 4,000 subscribers. Four shares of New England stock were exchanged for three of Southern Massachusetts. General Thomas Sherwin is president, and the other officers are: Treasurer, William R. Driver; assistant treasurer, Samuel Ivers; clerk and auditor, Samuel W. Leedom; assistant clerk and auditor, James P. Francis; general manager, Jasper N. Keller; assistant general manager, W. J. Dener; superintendent, B. E. Waters. The directors will be Charles F. Ayer, Moses G. Parker, Samuel Ivers, Charles W. Clifford, John E. Hudson, Jasper N. Keller and Thomas Sherwin.

The Board of Public Works of New Bedford, Mass., has granted a franchise to the Automatic Telephone company of New Bedford. This is a local company, with $100,000 capital. The officers are: President, F. T. Akin of F. T. Akin & Co.; treasurer, Frederic Taber, president New Bedford Safe Deposit and Trust company; clerk, A. E. Perry, of Knowlton & Perry. The Strowger automatic-telephone system will be used, it is said. This system was investigated by Mayor C. S. Ashley and Samuel C. Hunt, who went as far as Augusta, Ga., to see the actual working of the system.

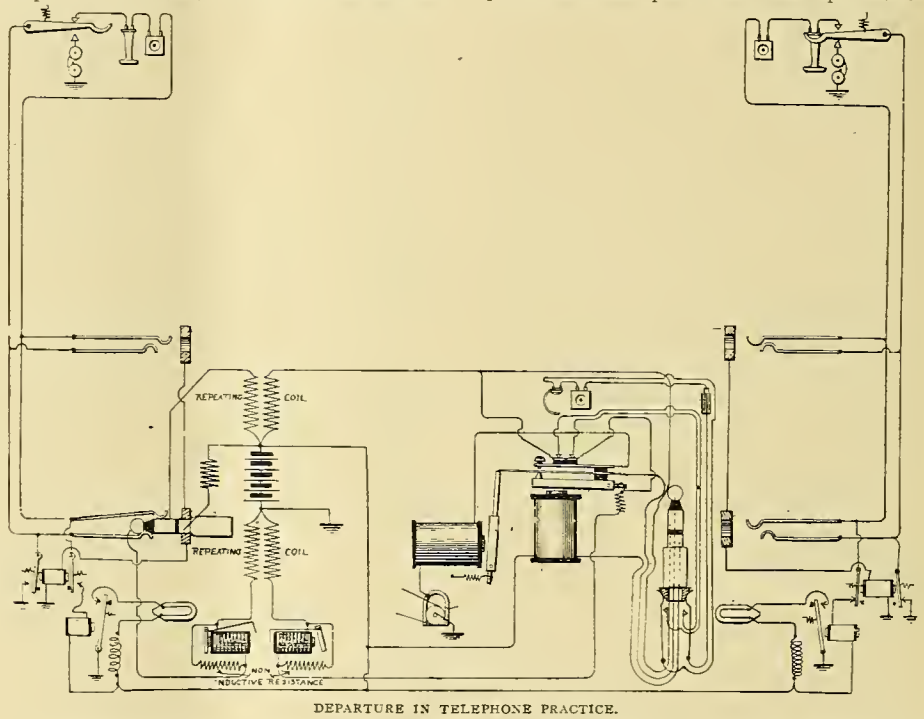
The officers of the recently incorporated Worcester Telephone company, Worcester, Mass., are: President, Henry F. Harris; vice-president, J. Russell Marble; treasurer, Hon. William P. Searles; clerk, William S. Slocum; with a number of prominent citizens as directors.

Departure in Telephone Practice.

The accompanying diagram shows a new telephone-exchange system in which the manually controlled ringing and listening keys are replaced by automatic keys operated by relay mechanism, each relay mechanism being controlled by an operator's connecting plug.

While telephone-exchange practice has reached a high state of perfection in many respects, switchboards are still provided with manually operated listening and ringing keys. Mr. William W. Dean has successfully solved the problem of dispensing with manually operated ringing keys. The system shown in the illustration employs mechanism which not only automatically operates the ringing keys, but also automatically operates the listening keys, a single electromagnetic appliance being employed, associated with each cord circuit, which is so organized and controlled by the switching apparatus employed in connecting subscribers for conversation that all of the various operations of the ringing and listening keys are automatically accomplished in orderly sequence. The new system was devised by Mr. George L. Cragg of the patent-law firm of Charles A. Brown & Cragg, and is patented by letters patent No. 629,957, issued August 1st.

When the modern relay-telephone switchboard was put into service, a remarkable increase in the capacity of the operators was gained. By dispensing with manually operated keys associated with the operator's cord sets, it is obvious that the number of motions necessary to be made by the operator would be considerably reduced, the operator merely having to manipulate the answering and connecting plugs, so that, in establishing a connection, she would have to make only two motions, instead of four. In disconnecting she would make two more, the total number of movements in the new system in connecting and disconnecting being four instead of six. Mr. Cragg suggests the possibility of still further reducing the motions to one in effecting a connection and one in effecting a disconnection, so that the total number of the operator's manipulations will be two, instead of six. He suggests the feasibility of the employment of relay mechanism adapted automatically to connect a calling line with the answering end of a cord circuit, which at the same time will operate a signal, so that the operator would have to manipulate only a single plug in connecting and disconnecting, the answering plug being totally replaced by the relay apparatus. It is obvious that by such a system the line indicators could all be dispensed with and replaced by indicators associated with the cord circuits, a fewer number of indicators, associated with the cord circuits, replacing the larger number of line indicators.



DEPARTURE IN TELEPHONE PRACTICE.

New Work in Nebraska.

The Telephone Exchange and Construction company of St. Louis, of which Mr. Henry A. Coit is the general manager, has a great deal of new work in contemplation, as well as that which is already under way through Nebraska. In addition to the installation of a new exchange at Syracuse, Neb., the company is building toll lines to connect the Nebraska City exchange, which Mr. Coit built last winter, with Syracuse, Julian, Union and Plattsmouth, Neb. Mr. Coit believes in good construction. The exchanges are all full-metallic and the toll lines are copper-metallic circuits.

Illinois Telephone Company Increases Its Stock.

At a stockholders' meeting on Monday the Illinois Telephone and Telegraph company voted to increase the capital stock from $250,000 to $5,000,000. Provision was also made for an issue of $5,000,000 of gold bonds bearing interest at the rate of 4½ per cent. and running for a period of 30 years. It was also decided to increase the number of directors from three to seven. The names are withheld, and it is said that they will not be given out until the closing of the negotiations for the financing of the company. President Wheeler says that he is now assured of the success of the venture, but will not give out the details until the construction work is actually under way. It is stated at the office of the company that several thousand subscribers have signed the new contracts, one assertion placing the number as high as 7,000. President Wheeler says that arrangements are now being made whereby a New York trust company will receive subscriptions to the bond and stock issues and give interim receipts, to be exchanged for the bonds and certificates as soon as they can be printed and delivered. He declines to say what company will act as trustee.

"This company pledges itself to the public that the contemplated plant shall be built," Mr. Wheeler is reported to have said after the meeting of Monday, adding that every mile of the outside wiring system had been platted and that specifications would be ready for the bidders by September 1st. It is proposed to let the contracts immediately and to break ground on September 10th at many points in the territory bounded by Fullerton and Western avenues and Fifty-fifth street. The underground system is designed to cover a territory of 30 square miles. Simultaneously with the building of the conduits, it is promised that pole lines shall be erected in the outlying districts, and by December 10th President Wheeler says that the company will begin stringing wires and drawing the cables into the conduits.

Combination in Missouri.

The deal between the Missouri and Kansas Telephone company of Kansas City, Mo., and the Standard Telephone company of the same place was completed early in the month. By the terms of the contract the Missouri and Kansas Telephone company purchases the parallel lines of the Standard Telephone company, being about 125 miles, and the Standard Telephone company uses the Bell instruments on all its lines, making direct physical connection at all junctional points. The Standard Telephone company owns and operates about 1,100 miles of lines within the state of Missouri, and under the present arrangement it expects to double its mileage within a year. The Standard Telephone company has a capital of $30,000, and has been in operation a little over a year. The board of directors was recently reorganized, and the new officers are as follows: President, S. H. Bevins; vice-president and general manager, Charles Webster; secretary, Samuel J. Agnew.

It is reported that the Western Union Telegraph company is about to place a telephone system at Iowa Falls, Ia. It is now claimed that the Cedar Valley Telephone company will not attempt to place an exchange in that city.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Valley Telephone company of Michigan has filed a trust mortgage to the Union Trust company at Detroit for $150,000.

E. F. Bodle, the owner of the telephone system at Oaker, N. D., has sold out to Mr. Zitelow of Aberdeen.

The Wisconsin Telephone company will erect a $25,000 building at Racine, Wis., for use as offices.

A. T. Presson of New Richmond, Wis., has sold his telephone plant in that city to the Mississippi Valley company.

The Baraboo (Wis.) Telephone company will extend its lines to Sauk City.

The Elkhart Telephone company will soon begin to erect wires and put in poles in the city of Manitowoc, Wis.

W. M. Martin, who is now manager of the Marshfield (Wis.) Telephone company, will be succeeded by C. M. Dougherty of Grand Rapids, Mich.

The local telephone company, which has been organized at Monroe, Wis., is receiving the support of the town.

The demand for telephones occasioned by a reduction in the rate at Sturgeon Bay, Wis., has been so great that the company has been unable to keep up the supply.

A telephone line from Twin Valley, Minn., to Fossum, is being constructed. As soon as this is completed Flom will be connected on the same circuit.

The Northwestern Telephone company was not allowed to string wires for its long-distance lines at St. Paul, Minn. The ordinance requires the wires to be underground and the council refused to make an exception in this case.

The Northwestern Telephone company has purchased a site upon which to erect a building to be used as an exchange at Winona, Minn.

The City Council of St. Paul, Minn., has passed an ordinance by which telephone companies will not be allowed to charge toll for speaking with St. Anthony Park, a suburb of that city.

The Mississippi Valley Telephone company has a force of about 150 men at work in St. Paul, Minn., stringing wires and getting the system in order. The exchange will soon be installed and it is expected that there will not be less than 1,200 subscribers by September 1st.

A new telephone line is being placed between the towns of Trout and Melrose, Wis.

The telephone line being built between Menahga and Sebeka, Minn., is nearly finished.

The City Council of Dubuque, Ia., has granted a franchise to the Standard Telephone company, and a large force is already at work putting in the system.

H. W. Conant of Denison, Ia., is building a line from his system at that place to Omaha, Neb.

Captain H. A. Allen of Manchester, Ia., has again resumed the position of district manager of the Iowa Telephone company. He resigned his position to enter the volunteer army.

Germania and Bancroft, Ia., will soon be connected by a telephone line.

A new telephone company has been organized at Ida Grove, Ia.

The Northern Iowa Telephone company will connect Elma and Cresco, Ia.

Material for the construction of the Bellevue (Ia.) telephone system has arrived and work has been commenced.

Dysart, Rogerville and Garrison, Ia., will soon be connected by telephone lines.

Material has arrived for the construction of a line between Humboldt and Gilmore, Ia.

The town of Storm Lake, Ia., would not allow the Iowa and Nebraska Telephone company to enter the village. The question was decided at a special election.

The Iowa Union Telephone company will put in a metallic circuit between Sioux City, Mapleton, Ida Grove, Carroll, Rodney and other points in Iowa.

The Northern Iowa Telephone company has secured a site and will put up a building for an exchange at once at Cresco, Ia.

Brownville, David, McIntire, Little Falls and Stacyville, Ia., will soon be connected by telephone.

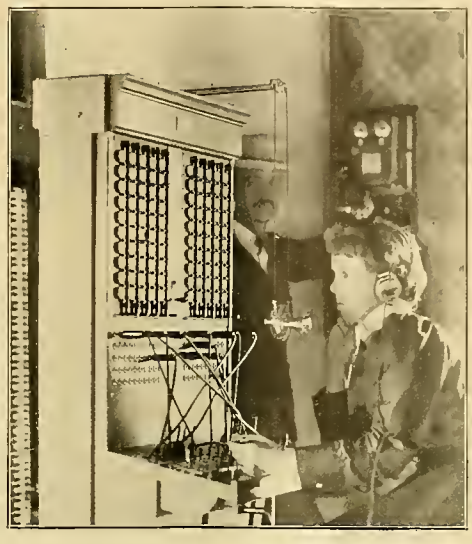
REPORTS AND ELECTIONS.

The Citizens' Telephone company of Houston, Tex., has elected C. C. Greenleaf of Wauseon, O., president; E. A. Glass, secretary; F. C. Bogart, treasurer, and A. L. Waterbury, general manager. The three last-named are residents of Houston.

At a meeting of the stockholders of the Union Telephone company of Easton, Md., the old board of directors resigned and their successors were elected. The new board is composed of Thomas L. Day of Ridgely, William H. Baker of Dover, Fred R. Owens of Denton and H. A. Richardson of Dover. Mr. Day is president, Mr. Baker vice-president and Mr. Owens secretary. The resignation of Wilson M. Tylor as treasurer was not acted upon. The affairs of the company were formally turned over to the new managers. Some improvements in the system are contemplated, one of which will better the service at Oxford.

Exchange at Minneapolis, Kan.

A small independent telephone exchange has been installed at Minneapolis, Kan., by F. H. Whitaker of Topeka, Kan., and the switchboard, built by the American Electric Telephone company of Chicago, is shown in the illustration. A local paper says that "The plant here is in good working order, every instrument giving the best of satisfaction, and already the people who have them are wondering how they got along without a telephone as long as they have." It is one of the functions of the Independents to



EXCHANGE AT MINNEAPOLIS, KAN.

put in telephones in small places where no telephones were before, as in this case. Mr. Whitaker is now overhauling the telephone plant at Delphos, Kan.

Notes from Central Illinois.

[From a correspondent of the Western Electrician.]

A company is being organized at Carlinville, Macoupin County, to be known as the Macoupin Telephone company. Its purpose is to maintain a central exchange in Carlinville, the county seat of Macoupin County, and build toll lines over the county to connect all outside towns. Carlinville has 5,000 inhabitants and has had a small exchange for the last five years, with only 100 telephones. The old exchange has been absorbed by the Bell people, who are trying to keep out opposition, but the new company will soon have a franchise and be incorporated under the laws of the state, with a cash capital of $10,000, and with J. B. Listen, Theo. C. Loehr, J. A. Fletcher, Robert Whitely, Jr., and some 20 others as incorporators.

A franchise has been granted by the council at Carlinville, Ill., to the Girard Telephone company, for a toll-line connection from Girard, Nelwood, Virden, Auburn, Modesto, Waverly, Palmyra, Barr and Scottville. The Auburn Telephone company has the right-of-way and will build a toll-line from Auburn to Pawnee, and loop in to Divernon.

The Springfield Mutual Telephone company will be ready for work in that city about October 1st.

J. A. Fletcher is still building new lines in the northwestern part of Macoupin County and the southern part of Morgan County. He has now about covered a territory 30 miles square, connecting all towns as well as the farming country. Mr. Fletcher has been appointed deputy county clerk of Macoupin County.

The Palmyra, Girard, Virden and Waverly companies have each installed new switchboards in the last four months, increasing their capacities to 200 telephones each.

Chesterfield and Medora will soon be in the Independent field. They are organizing a company together.

NEW COMPANIES.

The new Angelican Telephone company of Angelica, Allegheny County, N. Y., has as directors Fred R. Pratt, Lewis C. Rice, Clarence L. Lathrop and David P. Richardson of Angelica.

The Continental Telephone, Telegraph and Cable company, with a capital of $1,000,000, was incorporated at Trenton, N. J. The incorporators are Henry C. Lucas of Philadelphia, Frederick T. Ealand of New Brighton, N. Y., and J. Herbert Potts of Jersey City.

The Ontario Telephone company of Western New York has been incorporated for the purpose of furnishing a telephone line from Canandaigua to Holcomb, Baptist Hill, Honeoye, Bristol Center, Bristol Springs and Naples. The company has been incorporated with a capital of $8,000, and the directors are George Blake, George Granby, Frank James, W. Housel, Naples; F. A. Jones, East Bloomfield; William H. Doyle, Bristol; John Ricketson, South Bristol. The officers are: President, George Blake, Naples; treasurer, G. R. Granby, Naples; secretary, Frank James, Naples.

EXTENSIONS AND IMPROVEMENTS.

Little Rock, Ark., is now on the long-distance circuit of the Bell people.

It is said that the Sunset Telephone company will extend its wires from Quincy to Reno, Nev.

The Inland Telephone company is building a telephone line from Asotin to Anatone, in Idaho.

The Oregon Telephone and Telegraph company is putting up a line from Butteville to St. Paul, Ore.

P. A. Newman of Runge, Tex., has the contract to put up a telephone line between Runge and Goliad via Charco.

Hearne (Texas) has long-distance connection with Palestine, and a local line is under construction to Franklin, via Wheelock.

The Wareham and Wood Telephone company of Manhattan, Kan., has replaced its old central-office equipment with new apparatus.

It is said to be certain that a 200-mile line to connect Nevada City and Quincy, Cal., will be built. The line will pass through Sierra County.

The Van Wert Home Telephone company, Van Wert, O., has modernized its central office by the installation of an entirely new exchange equipment.

Work has been begun on a telephone line from Matagorda, Tex., via Bay City to Louise, connecting there with the Southwestern company's system.

The Diamond State Telephone company expects to have connection with the Delmarvia company of Wilmington, Del., soon, and as it already covers the lower part of the state and reaches some Maryland towns, it will cover the entire state of Delaware when connection is made with the Delmarvia company. The line to Wilmington is now being built, and will probably be in service by the first of October.

The work of removing overhead telephone wires in Plainfield, N. J., has been begun, and will be continued until the last of them have disappeared from the principal part of the city. The linemen of the New York and New Jersey Telephone company, who have been stringing the four new trunk lines from New York to Plainfield, and two new trunk lines from New York to Somerville, have finished their work as far as the Netherwood hill, in South avenue. From that point a cable will carry these lines to South avenue and Richmond street, where the wires will enter the conduits.

The Salt Lake (Utah) Tribune says that the Rocky Mountain Bell Telephone company is to build to St. George and Pioche. The Sunset Telephone company contemplates building northeast from Los Angeles to connect with this line; thus a continuous circuit will be created from Los Angeles to Montana and the cities in the Northwest, via Salt Lake, Utah, and Boise, Idaho. The first step in this enterprise will be taken by the Rocky Mountain company, when it starts the Nephi-Manti line. A branch will probably extend from Joseph to Marysvale. Other important extensions are already well under way. Materials have been ordered to connect Idaho Falls with all settlements in Upper Snake Valley. Another contemplated line is from Ogden to Evanston, thence north to the Bear Lake settlement, and thence to McCammon, thus connecting with the main north and south line.

MANUFACTURERS AND DEALERS.

The Sterling Electric company, Chicago, reports a great demand for its sectional Bell-type switchboards. Among recent customers are the Nevada Telephone company, Nevada, Ia.; Moravia Telephone company, Moravia, Ia.; Chillicothe and McArthur Telephone company, McArthur, O.; Cambridge Mutual Telephone company, Cambridge, Ill.; Charleston Telephone company, Charleston, Ill.; Montcalm County Telephone company, Stanton, Mich.; Valparaiso Telephone company, Valparaiso, Ind.; Home Telephone company, Kentland, Ind.; Lee County Telephone company, Earlville, Ill.; Jo Daviess County Telephone company, Stockton, Ill., Warren, Ill., Apple River, Ill., Scales Mound, Ill., and Nora, Ill., and the Crowley Telephone company of Crowley, La.

The Western Electrical Supply company of St. Louis was among the first to see the unlimited possibilities which the Independent telephone movement has opened up. By persistent efforts and hustling, this company has kept up with the times and gradually enlarged its telephone department until to-day it carries one of the largest stocks of telephone-exchange and line material in the West. It has been quick to see and add to its telephone department anything new and good in that line as soon as it came out. The company is just putting on the market its latest improved 1900 telephone, which has many new and novel features, among which is its transmitter, which is entirely moisture and damp-proof. It claims that this transmitter will out-talk any on the market, and that it cannot pack. The transmitter proper can be removed and replaced in a moment. The company is always glad to send the instrument on trial subject to return if not satisfactory.

Electric Gas-lighting Attachments for Candle Burners.

Among the various devices used for igniting gas jets, those in what are known as "imitation candle burner" are the most difficult to apply. It is impossible for the manufacturer to carry them in stock, for the reason that the chandeliers supplied with such candles differ from one another in the same house, in external appearance and form of candle, they varying to suit the peculiar ornamentation and style of the fixture itself. Again, frequently only a part of the candles on a fixture are to be

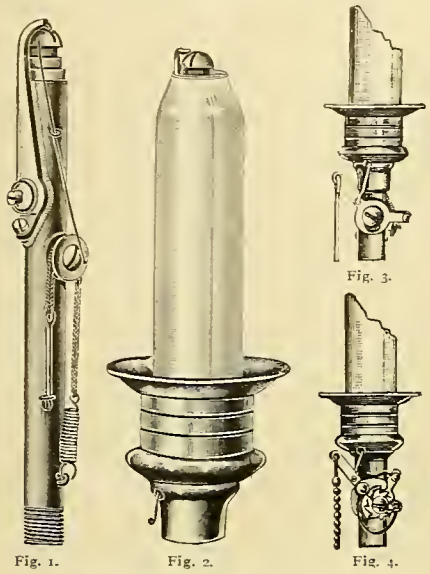


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

ELECTRIC GAS-LIGHTING ATTACHMENTS FOR CANDLE BURNERS.

electrically connected, but they must all correspond, when finished. They must therefore be taken from the fixture, and the electrical attachments applied to each separately.

These burners consist of a sconce, or metal shell, and a brass stem passing up through the center, carrying the tip. Over this stem is slipped the porcelain candle, frequently extremely small and irregular as to its interior. The operating mechanism for producing the spark must be attached to the brass stem, in this cramped space, and still be free to move readily without sticking or short-circuiting, but permitting of the taking off and on of the candle at any time.

Fig. 1 represents the method of fitting adopted by the A. L. Bogart company of 123 Liberty street, New York. The fixed electrode is secured to the upper part of the stem by a screw, insulated from the electrode by a special bushing. The electrode is so curved that its interior portion clasps the circumference of the stem, but a heavy mica non-conducting piece extends upward the entire length of the electrode to the tip between the former and the stem, thus not only perfectly insulating the electrode, but preventing it from shifting its position. The pulley wheel carrying the movable electrode wire is secured by a brass screw, thus obviating any possibility of rust causing the pulley to stick. Although there is no pinching or hammering together of the stem to accommodate the pulley wheel, the parts are so compact that the smallest porcelain candle used may be readily slipped over them.

Fig. 2 shows one style of completed burner. Figs. 3 and 4 are respectively candle burners using the same form of stem, but fitted in the first case with a stop-cock operated by a stiff pendant wire, and in the second a ratchet cock acting by alternate pulls on a chain. This company also fits candles with a particularly small and neat automatic attachment operated by a push-button.

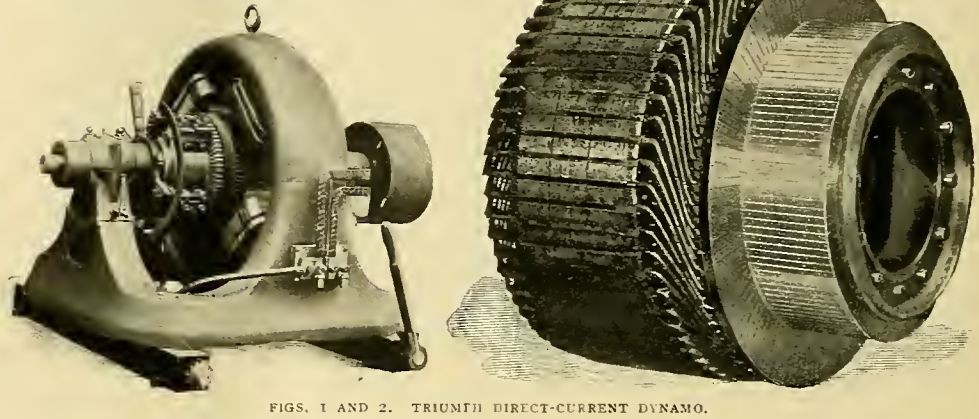
Failure of Zinc Trust Project.

The zinc trust, as it affects America, has been declared a failure by the LaSalle producers, who control the American market, writes a LaSalle (Ill.) correspondent of the Chicago Record. St. Paul de Sincay of Anglent, Belgium, head of the European syndicate controlling those markets, has been in LaSalle in consultation with the heads of the Matthiessen and Hegeler plants and the Illinois Zinc company in regard to the project, and no understanding as to uniform prices or trade arrangements has been reached. The reasons for the impracticability of the project are many. Competition in the home market is especially strong, and the contending American interests have no wish for combination. It is generally thought that the move of the European trust is inspired by fear of American competition, as the foreign business of the American companies is growing rapidly. The Belgian magnate has gone to inspect the Joplin (Mo.) zinc fields. He has, it is understood, not yet given up hope of the ultimate formation of the greater trust. If formed, the holdings of the trust would amount to $90,000,000.

Triumph Direct-current Dynamo.

The Triumph Electric company of Cincinnati has been in the field for seven years and claims that there is no more carefully designed or better made apparatus in the market. It prides itself particularly on fine machine work and the reliability and durability of its dynamos and motors.

In the accompanying illustrations Fig. 1 shows a small belted dynamo and Fig. 2 a bar-wound armature. The Triumph direct-current type of machines has cast-iron multipolar frames, with laminated pole-pieces and cast-steel pole shoes. Excepting in the smaller sizes, bar windings in armatures are used exclusively without band wires. The armature cores are ventilated horizontally by circular punchings and vertically by distance pieces between the plates. The armature coils are liberally insulated by the best India mica, enclosed in the strongest tape and fiberite board. The commutator bars are drop forged and of such surface that the carbon brushes have never to carry more than 30 amperes per square inch. The bearings are of the best gun-



FIGS. 1 AND 2. TRIUMPH DIRECT-CURRENT DYNAMO.

metal and of the ring-oiling and self-aligning type.

Particular attention has been given to the cool running of the machine, even on 50 per cent. overloads, as is shown by the weight of the material used. That the work of the Triumph company is not experimental is demonstrated by the 1,600 machines of from one to 400 kilowatts placed in the West. The belted machines for railway work are made extra heavy, both in bearings and windings, and will, it is said, take care of as much as 100 per cent. temporary overload without injurious heating or sparking. In sizes above 200 kilowatts a third bearing is used.

The western office of the Triumph company is under the management of Gates & Randolph, at No. 13 Monadnock block, Chicago.

Four-cent Fare for Milwaukee.

The Milwaukee Electric Railway and Light company, at the meeting of the Common Council on August 14th, presented a proposition to grant a four-cent fare on its lines and to give the city the right to purchase the road. The movement was made by the railway company with the object of settling the differences that have existed between the company and the city for some time. It is hardly expected that the propositions submitted will be granted in their present shape, but an amicable settlement is looked for.

The propositions of the company were referred to a special committee, and in brief, read as follows:

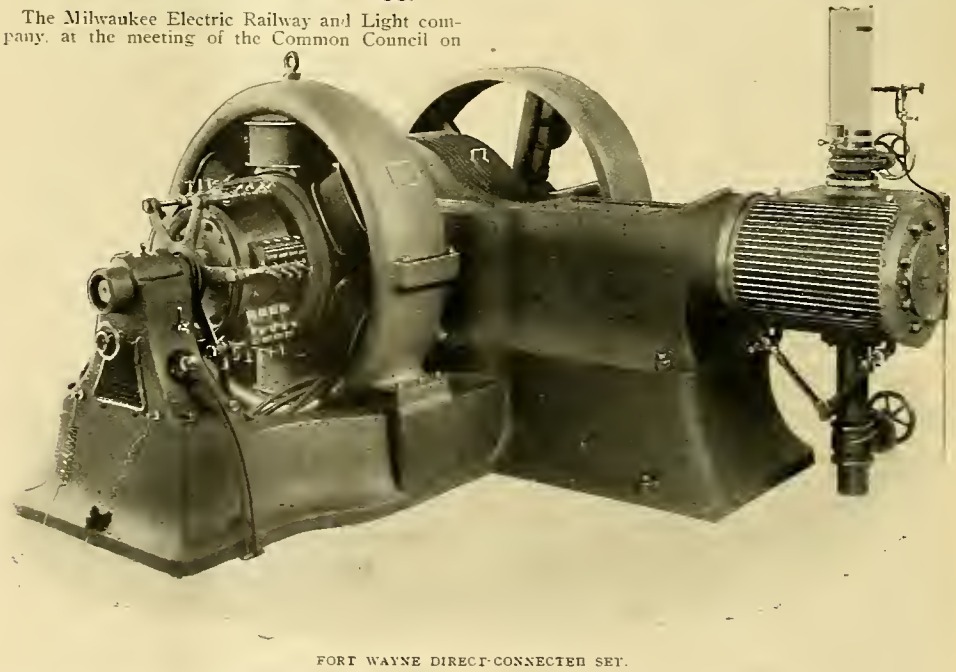
The company will gradually, through the sale of commutation tickets, reduce fares to four cents. It will make the present universal-transfer system permanent. It will extend its lines wherever the public necessities demand. At the expiration of its franchises the company will sell its lines to the city if the latter wishes to buy, the price to be settled by arbitration, if necessary. In return, the company asks: That its franchises be extended 10 years. That it be given franchises on such streets as will permit it to perfect its system.

Explosion of Acetylene Plant.

The acetylene-gas plant installed in Wabash, Ind., eight months ago by the Logansport and Wabash Valley company, the first in the world to use acetylene for public illumination, was entirely destroyed on August 7th by an explosion. A few minutes prior to the explosion the tanks were freshly charged with calcium carbide and water, and it is supposed the pressure increased too rapidly. The gas supply of the city is cut off for several weeks.

Fort Wayne Direct-connected Set.

The direct-current, direct-connected generator which the Fort Wayne Electric Works of Fort Wayne, Ind., manufacture is shown attached to engine in the illustration. The general appearance of these generators is attractive, and the construction is said to be the best that good design and skilled workmanship can produce. The generators are made with six poles, excepting the largest size, which has eight poles. The cores of the field magnets are of laminated iron, cast in place in the frame. The iron-clad drum armatures are barrel-wound with formed coils placed in the slots of the laminated sheet-iron core, the coils being securely held in place by binding wires.



FORT WAYNE DIRECT-CONNECTED SET.

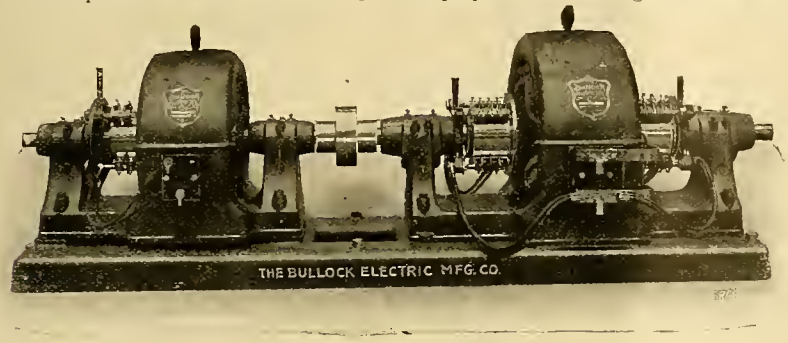
The commutator is of solid construction, the segments being made of a special grade of copper peculiarly adapted to this work. The brush-holders are designed for heavy service, and besides being substantial are convenient to adjust. The brushes are shifted by turning a small hand-wheel. The Fort Wayne people furnish a suitable field-regulating rheostat, as well as the field magnet, armature, outside pedestal with bearing, yoke mechanism, brush-holders and binding-posts.

Storage-battery Booster.

The Bullock Electric Manufacturing company, Cincinnati, Ohio, has recently shipped to the La Capital company, Buenos Ayres, a booster, to be used in connection with the extensive electric system of this company. The illustration clearly shows the general features of the machine, which consists of a 100 horse power motor, adapted to use current from the railway feeders varying in pressure from 550 to 650 volts. At the latter pressure the speed is 1,000 revolutions per minute. The generator has a double commutator and is compound-wound, with a capacity of 1,000 amperes at 60 volts or 500 amperes at 110 volts. Provision is made at the switchboard for using the shunt and series coils separately, the series winding giving a pressure of 60 volts, while the shunt winding produces 110 volts. The machine is equipped with shaft oscillator, which is of the automatic magnetic type.

The machines are rigidly connected by a flanged coupling and are mounted on a heavy, iron sub-base, which gives perfect alignment. While under test, in the presence of the purchaser's engineer, this machine was shown to possess a perfect electrical and mechanical balance and to run cool throughout its several parts.

This is the second booster the Bullock Electric Manufacturing company has furnished the La Capital company, which speaks well for the Bullock apparatus. Only the best machinery is selected for this far-off installation, as failure so far from the source of production would be disastrous to the business interests of the operating company.



STORAGE-BATTERY BOOSTER.

Electrical Power for Threshing-machine Factory.

The Advance Thresher company of Battle Creek, Mich., which owns one of the largest threshing-machine and traction-engine manufacturing plants in the world, is making some extensive improvements to its works. Four new buildings are being erected. One will be used as a power house and will be 55 by 85 feet in size. A Bates-Corliss engine of 400 horse power capacity will be installed by the Bates Machine company of Joliet, Ill. A 300-kilowatt Westinghouse two-phase alternating-current generator will be rope driven by the engine and will furnish electricity for power and lighting purposes. The factory machinery will be driven by 28 induction motors, ranging in size from five to 40 horse power each. A new round brick chimney is to be built, to be 125 feet in height. Another new departure will be an exhibit room, where machines can be seen in full operation.

Chicago Edison Company Not Absorbed.

Moved, doubtless, by the consolidation of lighting and street-railway interests in eastern cities, the Chicago daily newspapers have been reporting and then contradicting "quiet negotiations" by which the new Chicago Union Traction company was to absorb the Chicago Edison company and presumably the Commonwealth Electric company also. Some time ago there was a similar rumor, by which the People's Gas Light and Coke company was to be the absorber and the Chicago Edison company the absorbee. Nothing came of that report, and Mr. Insull, the president of the Chicago Edison company, says that one story is as reliable as the other. Whatever the future may hold, the Chicago Edison company is now doing business in its own name and for its own stockholders.

Western Electric Company Increases its Capital Stock.

The Western Electric company of Chicago has filed a certificate at Springfield, Ill., certifying to an increase of capital stock from $3,500,000 to $8,000,000. The increase was decided upon at a meeting of the stockholders a few weeks ago, and is simply a move necessitated by the rapidly increasing business of the company. New and better facilities for the manufacture of electrical goods will be added to the present factories in Chicago and New York, the definite plans for the future being left in the hands of the directors.

On August 1st the citizens of Hastings, Neb., voted in favor of issuing $20,000 electric-light bonds.

CORRESPONDENCE.

New York Notes.

New York, August 14.—Bernard M. Shanley, the capitalist who is promoting the union of the leading traction companies in North Jersey, gives out the information that the Paterson Railroad company, the White Line Traction company, the North Hudson County Railroad company, the Palisade Railroad company and the Saddle River company will all be operated, when the proposed consolidation has been consummated, under the name of the Jersey City, Hoboken and Paterson Railroad company. This will be a complete line that will extend all the way from Jersey City ferry at Exchange place to Little Falls. Mr. Shanley sails for Europe soon and the union will not be effected, it is said, until his return late in the fall. In this connection it is announced that Vice-president Hobart has sold all his holdings in the Paterson Street Railway company, tendered his resignation as president of that company, and brought about the selection of Mr. David Young as his successor.

It has been reported that the officers of the Staten Island Electric company contemplate bringing a suit against the city to recover $160,000, which they allege is due for lighting the streets. The company furnished the lights for the island before its incorporation as a borough of New York city, and since then has received no payments from the city, although the company claims that official authority was given it to continue to furnish lights. The lights have been cut out recently, as the company does not propose to provide illumination any longer without being paid. Many complaints and communications protesting against the darkness of the streets have been made against the city by the taxpayers affected.

Notices have been sent out to stockholders that the first installment of subscriptions to the Electric Axle Light and Power company will be due this week. This company, it will be recalled, was incorporated in New Jersey a few weeks ago with a capital stock of $25,000,000. It is one of the Rice-Whitney electrical companies, and proposes to enter the car-lighting field and also take up the refrigeration of cars.

The Long Island Railroad company has recently been testing a third-rail electric road on a half-mile stretch near Jamaica. The system is said to consist of a copper cable carrying the current, which is set in a hollow wooden beam running along the ties parallel with and equidistant from the rails. On top of this copper cable, according to a printed description, is another smaller cable, about the size of a telegraph wire, lying loose. As a train passes along a powerful magnet on the bottom of the cars lifts this smaller wire, which thereupon becomes electrically charged for the length of the cars, but, it is asserted, is at the same time dead and harmless two feet ahead of or behind the car.

Permission has been granted to the Westfield and Elizabeth Street Railway company, known as the Riker-Hine syndicate, to construct a branch of its trolley line from Westfield through Cranford to Rahway, there to connect with the Union and Middlesex Trolley company. The company is nearing Roselle with its trolley line, and will shortly be at Elizabeth.

The American District Telegraph company of Brooklyn has reduced its capital stock from $200,000 to $100,000, and the stock of the Pacific Postal Telegraph-cable company of this city has been reduced from $1,000,000 to $100,000. Among the directors of the latter company are R. V. Dey, John W. Mackay, William H. Baker, Charles R. Hosmer and A. B. Chandler.

Traffic on the Brooklyn Union elevated railroad was blocked for nearly two hours, during the rush time Friday morning, owing to the derailing of a car at the junction of the tracks leading from the bridge terminal to the main line at Adams and High streets.

The E. P. Allis company is erecting a number of large vertical cross-compound engines, direct-connected to electric generators, at the new Ninety-sixth street power house of the Metropolitan Street Railway company. Hydraulic pressure is being used to force the flywheel hubs, the spiders of the generators and the cranks onto the main shafts. These latter are 34 inches in diameter in the bearings, 37 inches in the center, 27 feet four inches in length and weigh 70,000 pounds each. With spider, cranks and flywheel mounted the total weight of each main shaft will be 456,150 pounds. M. S.

Northwestern Notations.

Minneapolis, August 11.—The council of St. Cloud, Minn., has indicated a change of heart in the matter of granting a franchise for an electric-light and power system to the Benton Power and Traction company, and it is understood that orders are being placed for new material for the proposed system.

The Oshkosh and Stevens Point Railroad company has filed a proposition with the city of Oshkosh, Wis., asking the latter to subscribe $15,000 worth of stock as an inducement for the construction of the proposed electric line.

The Edison Light company paid to the city of Des Moines, Ia., one per cent. of the gross receipts of the Des Moines Water Power company, amounting to $251.15, for the year ended June 30th.

The Duluth Street Railway company of Duluth, Minn., paid personal taxes amounting to $18,000 recently, for the years 1895, 1896, 1897 and 1898.

The Citizens' Traction company expects to have the interurban line to Neenah, Wis., running by August 15th.

A strike on the street cars in Sheboygan, Wis., has been averted. The motormen were ordered to carry $10 worth of change at all times, and those with families claimed they could not do so on their present wages. Three of the men quit and their places were filled without trouble.

Thirteen conductors on the street railway of Waterloo, Ia., were discharged and three were arrested on a charge of conspiracy to defraud the company. This is a penitentiary offense in Iowa. The management claims that for several months three of the conductors have been working a plan of issuing bogus transfers, by which they have defrauded the company of several thousand dollars.

The storage batteries furnishing power and light at night in the court-house at Minneapolis require extensive changes and improvements, which are expected to result in saving to the county. These batteries have never been equal to the demands upon them, and they are now in such condition that the company from which they were bought has been asked to submit a bid for a new outfit. The company will give a guarantee for a year, and after that time the repairs are not to cost to exceed 10 per cent. per annum.

The Erie Iron Works of Erie, Pa., secured the contract to furnish the electric-light plant for the city of Elroy, Wis., at $9,200.

The Jackson Milling company has been granted a franchise for an electric-light plant at Stevens Point, Wis., after a bitter fight.

The employes of the Chippewa Valley Electric Railway company, operating a trolley system through Eau Claire and Chippewa Falls, Wis., sent a petition for shorter hours, no dockage for delays by power failing and permission to sit down outside the city limits of Eau Claire and Chippewa Falls. They claim they are getting about 12½ cents an hour, and prices of everything, including labor, have gone up and they should share in it. The petition was presented through an attorney to prevent the possible discharge of a committee, should one be appointed to present it. The officers of the company reside in Boston. Word was sent that they would treat with the men and deal fairly, but they would not deal with an outsider. There was a strike among the men laying track for this company. They demanded 15 cents advance over the $1.50 per day they have been receiving.

W. M. Burgess of Duluth, Minn., expects to develop the water power of Black River Falls, a few miles from Superior, Wis., and transmit the power electrically to Duluth and Superior.

Those interested in the development of the water power of the St. Louis River above Duluth, Minn., will make the city a proposition to put in an electric-light plant and light the streets for five years at between $40 and $50 per arc light per year, and at the end of the time turn the plant over to the city for a nominal consideration.

Indiana capitalists are being addressed to interest them in an electric line from Dodgeville, Wis., to Mineral Point and other towns in the county.

The Twin City Electric company of Centralia, Wis., voted to charge 50 cents extra per share on all stock subscribed after August 15th.

An electric-car line is projected to run from Forest City, Ia., to Waterloo. There are 11 water power dams along the line which could produce electricity if equipped with dynamos.

Fairbanks, Morse & Co. of St. Paul secured the contract to put in an electric-light and water plant for Starbuck, Minn., for $6,360.

John T. Burke of Omaha secured the contract to furnish and install an electric-light plant for Seymour, Ia., at $7,032.

The Superior Rapid Transit company of Superior, Wis., has practically settled the matter of extending its lines to the suburb of Itasca, Wis.

The council of Hillsboro, N. D., is considering the matter of an electric-light plant.

The suit for damages against the Chippewa Valley Electric Railway company at Eau Claire, Wis., brought by Mr. and Mrs. Hugh Elliott, for injuries sustained in a collision of the defendant's street car with a railroad train, has been settled for $4,000. Mrs. Elliott lost an arm. J.

New England News.

Boston, August 11.—Major Edward T. Rowell, president of the Andover and Lowell Street Railway company, ex-postmaster of Lowell, president of the Courier-Citizen-Journal Publishing company of Lowell, and prominent in the Mill City in various capacities, died very suddenly last Friday afternoon on a train while en route from this city to Lynn. He was a graduate of Dartmouth College in 1861, having been born in the Granite State at Concord in 1836. He gained his military title by service in the Civil War, and was wounded at Gettysburg and Petersburg. He served as postmaster in Lowell under Grant, Hayes, Garfield and Arthur. He was Massachusetts state gas commissioner for five years. In 1897 and again in 1898 he was elected to the state Legislature. Few men have been so closely identified with the interests, both mercantile and philanthropic, of the city of Lowell in recent years.

At the meeting of the stockholders of the Boston Electric Light company, held on Tuesday, the officers were re-elected, with F. A. Gilbert as president and Samuel S. Sias clerk and treasurer. It was voted to issue 5,000 shares of new stock, bringing the total capitalization up to 30,000 shares, or $3,000,000. The directors were authorized to sell the company's former plant in South Boston. The annual report notes the completion of the company's fine new station, to which the business of three of the old stations will be transferred soon, effecting a great saving in operation expenses. This new plant is in South Boston. President Gilbert also states that a renewal for 10 years of the company's contract with the city of Boston has been effected. He adds that it is the purpose of the management to connect all its circuits in the city proper with the new South Boston station before long, thus making a still greater saving. The report makes the following financial exhibits:

	1899.	1898.	1897.
Gross earnings	$910,892	$809,943	$759,643
Expenses	604,973	513,408	485,498
Profits	$305,919	$296,535	$274,145
Charges	53,522	63,082	55,501
Net for stock	$252,397	$233,453	$218,644
Dividends	143,908	102,000	110,500
Surplus	$108,489	$131,453	$108,144

The balance sheet of June 30th is as follows:

Plant accounts	$2,313,642
Real estate	1,198,699
Underground construction	1,255,914
Supplies on hand	102,737
Cash	34,398
Accounts and notes receivable	142,177
Total	$5,047,567
Capital stock	$2,500,000
First-mortgage 6 per cent. boods	293,000
Consolidated first-mortgage 5 per cent. bonds	957,000
Notes and accounts payable	767,788
Profit and loss	529,779
Total	$5,047,567

The messenger boys of the Postal Telegraph company in Boston went out on strike on August 1st. For a day or two there were some exciting encounters between the new boys and the strikers, whose places were readily filled. Several scrimmages with the police took place, and until they were re-enforced the bluecoats got rather the worst of the encounter. The trouble was of short duration, however, and quiet was soon restored.

The Massachusetts commissioner of corporations has authorized the Hanover Street Railway company to change its name to the South Shore and Boston. The company now includes the Braintree and Weymouth, the Bridgewater, Whitman and Rockland, the Hingham, and the Rockland and Abington roads, recently consolidated. To retire stock of the old companies an issue of 6,900 shares of new stock, amounting to $690,000 capital, is authorized. Mortgage bonds for $161,000 additional are also authorized. This makes the bonded indebtedness $600,000.

The Massachusetts Electric Companies, the big consolidation of street-railway companies outside the Boston and suburban system in the eastern part of Massachusetts, secure the Taunton and Brockton Street Railway company as their latest acquisition. This comprises 13 miles of road, capitalized for $100,000 stock and having outstanding $100,000 in five per cent. bonds.

B.

PERSONAL.

Mr. Arthur Hartwell, the manager of the Chicago office of the Westinghouse Electric and Manufacturing company, is taking a fresh-water vacation on the Great Lakes. Ervin Dryer, a salesman for the same company, having the Dakotas and Nebraska as his field, is spending a short vacation in Indian Territory.

Mr. Samuel Insull, president of the Chicago Edison company, denies the report that he has agreed to write a paper against municipal ownership, to be read at the convention of the League of American Municipalities to be held in Syracuse next month. Mr. Insull has neither agreed to attend the convention nor to write a paper for it.

Many friends of Mr. Marpole Willis, the electrical engineer, formerly connected with the General Electric company, will rejoice to learn that his health, which has been impaired for several years as the result of a serious accident, is now entirely restored. Mr. Willis was for some time compelled to live in the mild climate of the South, but he is now in this city and is confident that he can endure the discomforts of a Chicago winter.

Mr. W. F. Furbeck, long associated with the Yerkes street-railway interests in Chicago, has resigned the position of private secretary to Charles T. Yerkes. Mr. Furbeck contemplates a trip abroad and on his return will become associated with the banking firm of A. L. Dewar & Co. It is possible that he will also give up the other positions he holds in connection with the traction interests in Chicago and devote his time entirely to his private business. L. S. Owsley, now assistant treasurer of the Union Traction company, will take Mr. Furbeck's place as private secretary to Mr. Yerkes.

ELECTRIC LIGHTING.

Wadesboro, Mo., will hold an election on August 31st to decide the issuance of $25,000 of bonds for waterworks and electric-light plant.

Bids will be received between August 20th and 30th for the erection of an electric-light plant at Pulaski, Va. The plant will supply arc and incandescent lights and will cost about $9,000.

Fire destroyed one of the buildings of the electric-light plant of the Washington Traction and Electric company on August 9th, causing a loss of probably $50,000. The upsetting of a lamp in an adjoining building where gasoline was used caused the fire.

The work of extending the municipal arc-lighting system of Chicago is being seriously handicapped, according to City Electrician Ellicott, by the inability of the electrical supply houses to fill the city's orders. All of the companies are busy, and on this account the city officials believe they will be delayed in their work this year from 30 to 60 days.

An increase in the capital stock of the Edison Electric Illuminating company of Boston is proposed, and application has been made to the gas commissioners for authority to issue $750,000 new stock, which will bring the company's outstanding capital up to $4,670,000. As soon as the authority of the gas commissioners has been obtained, a special meeting of the stockholders will be called. Proceeds of new stock are to be used for new construction, general additions and improvements. On April 3d last the stockholders were offered the right to subscribe to 1,702 shares at $120 a share.

ELECTRIC RAILWAYS.

Lightning set fire to the power and car house of the Newark and South Orange (N. J.) Railway company recently. The fire burned three hours, destroying the structure. Eighty-five cars were burned.

The West Chicago Street Railroad company's offices have been practically abandoned, and the business of the company, now controlled by the Chicago Union Traction company, is transacted at 444 North Clark street, formerly the headquarters of the North Chicago company.

Chattanooga, Tenn., is having a serious street-railway strike. Considerable rioting has been done at different points of the lines, cars have been stoned and derailed and one of the company's depots has been completely wrecked. A boycott is said to have been declared upon all the roads employing non-union men.

By a vote of 24 to one, at a special session on August 11th, the Common Council of Detroit adopted the amendments to the ordinances of the Citizens' and Fort Wayne lines, changing the rate of fare from five cents to eight for a quarter. A hot legal fight will ensue. The Detroit Citizens' Street Railway company will undoubtedly refuse to obey the ordinances, and mandamus proceedings will be commenced to force it to show cause why it should not obey the enactments of the council.

AUTOMOBILES.

It is said that the proprietors of the Waldorf-Astoria Hotel of New York city will use a Chicago automobile in the delivery and express service of the hotel.

Boston has received its first municipal automobile, which was ordered by the mayor some time ago. It will be run by steam, generated by gasoline as a fuel, and will be used by the Public Buildings Department of the city.

The Harding Manufacturing company is considering the establishment of a plant in Chattanooga for the manufacture of automobiles and agricultural implements. The citizens of Chattanooga are asked to subscribe $100,000 toward securing the plant.

The bicycle and automobile exhibit at the Paris Exposition, says Major Brackett, secretary of the United States Commission to the Paris Exposition, will be in the building at the Bois de Vincennes, provided for the housing of the railway exhibits of all countries. A track some two miles in length, running around the Lake Daumesnil, has been provided for showing automobiles and motor vehicles of all kinds in operation. A space of 4,300 square feet in the automobile building has been secured for American exhibitors. According to indications, every manufacturer will be represented. The keen interest shown in this matter in foreign countries at the present time will make this one of the most attractive features of the Paris Exposition.

With a view to the addition of specially constructed automobile wagons for the collection of mail, James E. Bell, superintendent of delivery in the Washington postoffice, has made a preliminary test of collecting mail over one of the regular city routes in an electric automobile of the American Electric Vehicle company of Chicago. It is stated that the trial was very satisfactory, the collection route being covered in much less time than with a horse.

An automobile gun-carriage, upon which a Colt automatic rapid-fire gun will be mounted, is now being constructed at the Duryea factory in Peoria, Ill. It is being made to the order of Major Davidson of the Highland Park Military Academy. The vehicle will be a three-wheeled affair, seat four men, provide for 1,000 rounds of cartridges and weigh about 1,000 pounds. Major Davidson intends to run it overland to Washington, where an effort will be made to interest the army officials in the vehicle.

The New Jersey branch of the Whitney-Elkins automobile syndicate has completed its organization by filing a certificate increasing its capital stock from $100,000 to $1,200,000. The corporation, which is to be known as the New Jersey Electric Vehicle Transportation company, will be one of 20 companies, to operate in different states. It is said that the company intends to put an automobile service in every city of importance in New Jersey and to establish a continuous line of service between New York and Philadelphia. The headquarters of the company will be in Jersey City.

PUBLICATIONS.

Rosenberger's Pocket Law Journal of Chicago is bright and attractive in its new form. It is of pocket size, illustrated, and replete with instructive and interesting matter. Mr. J. L. Rosenberger, the editor and publisher, is an attorney who has made a specialty of legal intelligence, and he deserves success.

The latest bulletin of the Bullock Electric Manufacturing company of Cincinnati describes the details of construction of the Bullock engine-type generators. These machines have been designed to meet the requirements of the most exacting service and are suitable for direct connection to either steam or gas engines or water-wheels.

INDUSTRIAL COMBINATIONS.

It is reported in New York that there is to be a complete reorganization of the various compressed-air power companies and affiliated concerns, and that they are all to be merged into one central corporation, with Harry Payne Whitney, son of William C. Whitney, as president of the new company. The companies said to be affected are the New York Auto-truck company, capitalized at $10,000,000; American Air Power company, capital $7,000,000; International Air and Power company, capital, $7,000,000; Denver and St. Louis Auto-truck company, capital, $5,000,000; Philadelphia Auto-truck company, capital, $10,000,000; Pneumatic Carriage company, General Carriage company, Kelly Rubber Tire Wheel company. The capitalization of the central company, it is said, will be in the neighborhoood of $100,000,000.

In New York there is some talk to the effect that the Standard Oil capitalists are again preparing to push their big copper combination. It is said that the plans involve the absorption of several of the more important copper properties by the Amalgamated Copper company, originally designed as an absorbent for the desirable copper interests. It is asserted that several properties have been quietly picked up during the last month or two, and it is explained that the combination was not put through more rapidly because of litigation in progress between some of the western mining companies. The plan is to compromise this at the earliest practicable moment. Among the mines mentioned as likely to be the first acquired are the Boston and Montana and the Butte and Boston. Others in the same locality will be taken if the plans go through. It is said that several subordinate companies will be organized as a preliminary to the general merger.

TECHNICAL SCHOOLS.

Several changes in the faculty of the Worcester (Mass.) Polytechnic Institute have been made. Professor Albert Kingsbury, M. E., of Durham, N. H., has been appointed to the professorship of applied mechanics. He was graduated at Cornell University, receiving the degree of mechanical engineer in 1889. Previous to that time he had served an apprenticeship of three years in a large machine shop in Ohio State University. During the last eight years Professor Kingsbury has filled the chair of mechanical engineering at the New Hampshire College of Agriculture and the Mechanic Arts. He will begin work at the institute in September. Professor Forest R. Jones of Madison, Wis., has been appointed to the chair of machine design in the institute. For several

years he has held a similar chair in the University of Wisconsin. He also graduated from Cornell in 1888, served a long apprenticeship in one of the largest machine shops in the country before taking his degree, and added some years of field work as an engineer in the employment of the Westinghouse Electric and Manufacturing company. He has published a complete text-book of machine design in two volumes.

MISCELLANEOUS.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until August 22d for furnishing the Mare Island (Cal.) navy yard with three generating sets. Blank proposals will be furnished upon application to the bureau at Washington or to the Navy Pay Office at San Francisco.

TRADE NEWS.

The St. Paul office of the Fort Wayne Electric Works, which has heretofore been located at 203 Newspaper Row, is now at 615 Germania Life building. Mr. A. H. Savage, successor to Mr. O. Claussen, is now the salesman for the territory covered from St. Paul, Mr. Claussen having been appointed city engineer of that city.

Mr. H. V. Mann, western agent of the O. K. dry battery, manufactured by the Non-polarizing Dry Battery company of New York, was in St. Louis and Cincinnati last week, establishing local agencies for the O. K. battery. He reports an unusually good business among telephone and electrical firms and the railroad companies.

The Buckeye incandescent-lamp sales for July are said to have exceeded by many thousands all previous July records. The candle-power maintenance capacity of the special filament which is manufactured and used exclusively by the Buckeye Electric company is attracting much attention. A large stock is carried at Chicago for the benefit of the western trade.

The Babcock and Wilcox company has sold to the Manhattan Railway company of New York city the boilers required for the new electric generating plant of the latter, which will furnish electric current for operating its entire elevated-railway system in New York city. The boiler equipment will consist of 64 Babcock & Wilcox all-wrought-steel boilers of 520 horse power each, capable of carrying a working pressure of 200 pounds per square inch. The boilers will be fitted with Roney automatic stokers, manufactured by Westinghouse, Church, Kerr & Co. This is said to be the largest single order ever placed for stationary boilers.

BUSINESS.

"Look out for our exhibit at the National Export Exposition in Philadelphia," says the Onondaga Dynamo company of Syracuse.

The Electric Appliance company, Chicago, reports, as the banner success of the month, its success in introducing the Eldredge battery voltmeter.

Thompson, Son & Co. of New York report business as being very brisk. This firm has made recent shipments of several carloads of electrical machinery. It is making a specialty of rebuilt transformers for the fall trade.

Prof. J. W. Trotter, president of Trotter's Mona Manufacturing company of New York, guarantees his compound to be a perfect lubricant and spark preventer. This compound, although but recently placed upon the market, is receiving wide-spread attention, orders coming in for it from all parts of the country.

The Leather Preserver Manufacturing corporation, 27 West Monroe street, Chicago, reports that business is booming and it has all it can do. As is well known, this concern makes a specialty of repairing belts and also of purchasing old ones, no matter what their condition may be. It requests belt users to send to it any belts which they may wish to sell. The company will make an offer for the belts, and if not accepted the belts will be returned, freight prepaid.

The Central Electric company, Chicago, expresses its pleasure at the growing business in electric-railway supplies. Electric-railway companies may be said to be specialists in their requirements, though it is surprising how much they need from a general line of electric material. The combination, as exists with the Central Electric company, of keeping a comprehensive stock of electric-railway material in connection with a large line of general electrical supplies, affords the advantages of quicker shipments and reduced transportation charges, and the company says that electric-railway buyers generally are taking advantage of these benefits.

Among the more important sales of electrical machinery made by the Bullock Electric Manufacturing company during July were the following: Union Depot, Dayton, Ohio, 100 kilowatts; Fuller Construction company, New York city, 200 kilowatts; Wilson Aluminum company, Holcomb Rock, Va., 60 kilowatts; Warren K. Blodgett, Boston, Mass., 50 kilowatts; American Type Foundry company, Cincinnati, Ohio, 25 slow-speed motors; D. E. Whiton Machine company, New London, Conn., 30 kilowatts; United States government, San Francisco, Cal., 30 kilowatts; Pullman Palace Car company, St. Louis, Mo., 37½ kilowatts; Daily Mail, London, England, 100 horse power; Aldrich Mining company, Brilliant, Ala., 30 kilowatts; Missouri Lead and Zinc company, Joplin, Mo., 20 horse power; Boston News Bureau, Boston, Mass., nine horse power; Hanover Manufacturing company, Bethlehem, Pa., 10 horse power; Southern Electric company, St. Louis, Mo., 12½ kilowatts; Vulcan Metal Refinery company, Sewaren, N. J., 17½ kilowatts.

Gates & Randolph, 13 and 15 Monadnock block, Chicago, report having a lively trade in Triumph Electric machines. They are installing a 125-kilowatt belted street-railway Triumph generator for the Ottawa Railway company, Ottawa, Ill.; an eight-pole, slow-speed Triumph generator for a power plant for Braun & Fitts, butterine manufacturers, Chicago; a 62½-kilowatt Triumph direct-connected power machine and three motors for A. Schwill & Co. in a malt house; a 25-kilowatt lighting machine for the J. P. Smith Shoe company; a 25-kilowatt in the Kuntz & Remler restaurant; a 25-kilowatt for the Potter Wall Paper company, and several motors to the Gates Iron Works, Nelson Morris, Armour & Co., J. N. Johnson, Frazer & Chalmers, etc. They also report the sale of Empire instruments, Ideal and Victor circuit-breakers, Sterling arc lamps to the Siemens & Halske company, Mutual Electric company and others; also a 150-kilowatt Warren alternator to Manistique, Mich.; a 60-kilowatt Warren machine at Bayfield, Wis., and Diamond meters and transformers to Centralia, Wis., Bloomington, Ill., and other places.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 8, 1899.

630,318. Arc-rupturing Device. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed December 17, 1898.

The method of rupturing an electric arc which consists in dynamically acting upon the same by current derived inductively from the circuit in which the arc is formed.

630,330. Motor Controller for Printing Presses. Henry H. Cutler, Chicago, Ill. Application filed August 22, 1898.

The combination with a printing-press or other machine having a reciprocating table, of an electric motor for continuously driving the table back and forth without stopping, a motor controller for increasing the driving capacity of the motor, and means operated as the table approaches the end of its travel for actuating the motor controller to increase the driving capacity of the motor.

630,331. Motor Controller for Printing Presses. Henry H. Cutler, Chicago, Ill. Application filed August 22, 1898.

The combination with a printing-press or other machine having a reciprocating table, of an electric motor for operating the same, a motor controller, movable parts for operating the controller, one at each end of the travel of the table and connected so that the movement of one moves the other, and means for moving the parts as the table approaches the opposite ends of the travel thereof.

630,333. Diphase Electric Motors. Samuel W. Dietrich, Terre Haute, Ind., assignor of forty-nine one-hundredths to Robert W. Beebe, Terre Haute, Ind. Application filed November 8, 1898.

The motor has a field-magnet system composed of bipolar magnets isolated from each other and each having both poles presented to the armature space one ahead of the other, considered circumferentially thereof, and a single coil positioned relatively of the magnets to magnetize all of them. (See cut.)

630,345. Automatic Fire-alarm System. George C. Hale, Kansas City, Mo. Application filed December 3, 1898.

The apparatus combines a telephone system, a thermostat, a phonograph having a cylinder bearing a record indicating the location of the thermostat, means controlled by the thermostat for normally holding the reproducer of the phonograph in inoperative position, and a transmitter in the telephone system adapted to receive vibrations from the phonograph.

630,356. Motor Truck. Thomas J. Johnston and Arthur H. Abell, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed February 16, 1899.

A truck for heavy service, combining a metallic truck-frame spring-supported upon three axles, with two motors entirely within the wheel base, each of the motors carried at its free end by a spring support upon the intermediate axle.

630,466. Radiographic Apparatus. Samuel W. Puffer, Rochester, N. Y. Application filed February 27, 1899.

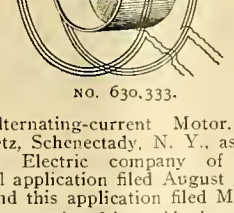
The apparatus combines a source of X-rays and a suitable receptive surface, with two parallel impermeable bars, arranged one between the source and the permeable subject and the other between the permeable subject and the receptive surface, and the adjustable impermeable indicators on the bars.

630,409. Dynamo-electric Machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 21, 1898.

The combination of the spider, the ring, the pole-pieces and the bolts securing both the spider and the pole pieces to the ring.

630,418. Method of and Means for Inducing Magnetism in Magnetic Circuits. Charles Steinmetz, Yonkers, N. Y., assignor to the General Electric company of New York. Application filed August 31, 1891.

The method of transforming alternating electric currents from one number of phases to another, which consists in inducing in a series of magnetic circuits magnetic waves by the magnetizing action of the currents to be transformed, modifying the phases of the magnetic waves to correspond with the current phases desired and inducing currents of the desired number of phases in a secondary circuit or circuits in inductive relation to such magnetic circuits. (See cut on next page.)



NO. 630,333.

630,419. Alternating-current Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric company of New York. Original application filed August 31, 1891. Divided and this application filed May 13, 1897.

The motor consists of the combination of a rotative element and two groups of field-exciting coils at right angles to each other, inclosing the rotative element and affording separate magnetic circuits, each of the groups containing a primary coil and a secondary coil, the primary coils being of unequal magnetizing power, connected in series and adapted to be supplied with single-phase alternating currents, and the secondary coils also of unequal magnetizing power and in a closed circuit.

630,448. Electromagnetic Reciprocating Engine. Mahlon S. Conly, Los Angeles, Cal., assignor of one-half to William H. Willson, Los Angeles, Cal. Application filed August 9, 1898.

The combination of an electrical generator, a magnetic plunger, a plunger cylinder around the plunger and slotted along its length, insulation between the lips of the slot, coils surrounding the cylinder, a magnetic metallic case inclosing the coils and the cylinder and formed in two or more longitudinal sections, insulation to insulate the sections from each other, a plunger-operated automatic electrical switch, electrical connections between the generator and the switch, and electrical connections from the switch to the coils.

630,466. Automatic Rheostat. James H. McGurty, Jersey City, N. J. Application filed October 11, 1898.

There is combined the resistance box and the swinging resistance bar thereof, electrically controlled means for swinging the bar, a governor shaft carrying a cross-head, a pair of flat-blade strips arranged parallel with the shaft respectively at opposite sides thereof, and provided at one end with attaching flanges abutting flat against one side of the cross-head, screws connecting the flanges of the blade strips with the terminals of the cross-head, the screws forming axes for the strips to turn upon, and also providing fastening means for holding the strips rigid, and a gear connection between the pivotal end of the resistance bar and the governor shaft. (See cut on next page.)

630,470. Electric Arc Lamp. Alexander Stuttmann, Russelheim, Germany. Application filed December 14, 1898.

An electric arc lamp, combining a set of converging carbons meeting at a point, each of which carbons has inlaid therein a continuous body of material along its side which is included within the angle of convergence, the carbons being of the same polarity with another set of converging carbons meeting at a point, each of which carbons has inlaid therein a continuous body of material along its side which is included within the angle of convergence, the converging carbons being of a polarity opposite to that of the first-mentioned carbons, whereby an arc may be maintained between the meeting points of the two sets of carbons.

630,475. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed May 6, 1899.

The features are a casing mounted on a car and having positive and negative circuit closers, a resistance intermediate the latter and the trolley-wire circuit, a lamp and its casing having projecting terminals for contacting with the circuit closers, one terminal and its coacting circuit closer having a following contact, the other terminal having a fixed contact with its coacting circuit closer.

630,489. Alternating-current Motor. Max Déri, Vienna, Austria-Hungary. Application filed January 12, 1898.

In alternate-current motors the combination of sets of windings or coils in the armature with resistance connections which are inserted between the junctions of the windings or coils in such a manner that in an alternating field with a certain number of poles the induced currents pass through the connections, but in an alternating field, the number of poles of which is different from above, these connections having no current, and switching devices arranged in connection with the field coils for producing in the motor fields having a different number of poles with different positions of the switching devices.

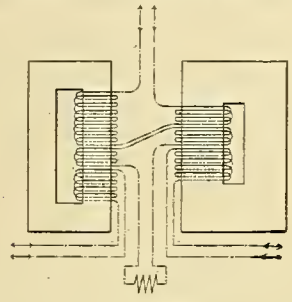
630,490. Dynamo-electric Machine and Method of Operating Same. Max Déri, Vienna, Austria-Hungary. Application filed June 30, 1898.

A combination current generator or motor is described having a field magnet with coils combined with a continuous-current source and an alternating-current source, one to produce a constant field and the other an alternating field with different numbers of poles in the same field magnet, and an armature provided with windings forming on the one hand short-circuits having the number of poles

corresponding with the alternating field, and forming on the other hand other circuits with the number of poles corresponding with the constant field.

630,491. Combined Alternating and Continuous-current System of Distribution. Max Déri, Vienna, Austria-Hungary. Application filed July 27, 1898.

The system consists of the combination of alternating-current transformers with continuous-current secondary generators connected in series and three leads therefrom, of which the electromotive force is added together in such a way that between two leads of the series a pressure giving rise to wave currents is produced, while between the one external lead and the connecting lead an alternating pressure and between the other external lead and the connecting lead a continuous pressure is produced.



NO. 630,418.

630,492. Arrangement for Exciting Magnets of Dynamo-electric Machines. Max Déri, Vienna, Austria-Hungary. Application filed February 23, 1899.

A dynamo having an armature and a field magnet provided with two sets of excitation coils, one set being compensation coils arranged uniformly like the armature coils, whereby the magnetic flow produced by the compensation coils shall be contrary to, but practically equal to, the armature field both as to form and strength.

630,501. Metallic Conduit for Electric Wires. Edwin T. Greenfield, New York, N. Y. Application filed December 12, 1898.

A pipe or conduit for electric wires vented radially in all directions throughout its length.

630,513. Electric Arc Lamp. Charles E. Morris, Chester, Pa., administrator of James E. Morris, deceased, assignor to Thomas Wilby, Chester, Pa. Application filed November 1, 1898.

The lamp has a magnet, a magnet core, a dash-pot provided with a piston head adapted for movement therein, a piston rod, a rigid or unyielding connection between the rod and the magnet core, and an opening or channel extending from above the piston head to below it and adapted to be automatically closed in the ascending movement and automatically opened in the descending movement of the piston rod.

630,539. Automatic Circuit Breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed April 25, 1898.

The circuit breaker has an overload or series coil, a shunt coil and a polarized relay controlling the circuit of the shunt coil, either the shunt or the series coil acting to open the circuit breaker.

630,567. Electrically Driven Spindle. Henry B. Sawyer, Newton, and Russell Robb, Concord, Mass. Application filed April 14, 1898.

One claim reads: The combination with a spindle having a flexible bearing, giving it a capacity for gyratory movement, of an induction motor rotor attached thereto and a stator attached to a stationary part of the machine, but separated from the rotor by an air gap sufficient to permit the gyratory movement of the spindle and attached rotor without contact between stator and rotor.

630,568. Dynamo. Herman B. Schneider, Chicago, Ill. Application filed July 13, 1898.

An armature is described having a block or support carrying and supporting a supplemental coil and a pivoted connecting arm, the supplemental coil being adapted to operate as a governor to the current generated by the armature as it is rotated between the poles of the magnets.

630,598. Electromechanical Perforating Machine. George H. Davis, New York, N. Y., assignor to the Æolian company, New York. Application filed December 12, 1894.

The combination with a piano or similar musical instrument operated by keys, of a perforating machine having a rapidly and constantly reciprocating punch block, a suitable die, a series of punches loosely carried by the punch block, locking devices carried by the punch block, and means operatively connecting the keys with the locking devices whereby a punch or punches will be locked to the punch block during the depression of a suitable key or keys.

630,612. Process of Producing Chromic Acid by Electrolysis. Max Le Blanc, Frankfort-on-the-Main, and Hermann Reisenegger, Höchst-on-the-Main, Germany, assignors to the Farbwerke, vormals Meister, Lucius & Brüning, Höchst-on-the-Main, Germany. Application filed August 19, 1898.

The process consists in first electrolyzing a solution of a chromium oxide salt in an aqueous solution of the corresponding acid, as for instance solution of chromium sulphate in aqueous sulphuric acid, then employing the mixture of chromic and other acid resulting from the electrolysis for reactions by which it is recovered into the solution of the oxide salt in an acid, charging this at the cathode when the fluid formerly at the cathode has been transferred to the anode for formation again of chromic acid, and so on continuously.

630,618. Automatic Regulator for Electric Motors. Albert T. Marshall, Brockton, Mass. Application filed August 29, 1898.

The regulator has a contact arm, means normally tending to move the contact arm in one direction, a thermostat and means controlled by the thermostat for stopping the contact arm in different relative positions. (See cut).

630,624. Gas-engine Igniter. Charles H. Morse, Jr., Chicago, Ill., and Frank G. Hobart, Beloit, Wis., assignors to Fairbanks, Morse & Co., Chicago, Ill.. Application filed February 6, 1899.

A gas-engine igniter comprising a fixed and a movable electrode, a shaft carrying the movable electrode, a projecting finger rotatably mounted on the outer end of the shaft, means for actuating the finger, and two springs co-operating with the finger, one forming a means for yieldingly transmitting the force of the actuating means to the shaft and the other normally holding the electrodes apart.

630,634. Protective Casing for Electric Cables or Wires. August Sundh, Yonkers, N. Y. Application filed March 28, 1899.

A flexible metallic wear-resisting protective casing for electric cables, consisting of coiled wires constructed in the form of a tube, and also constructed with part of the coils disposed for tensile strength of the case, and the case adapted for the cable to be drawn in and out.

630,635. Protective Casing for Electric Cables or Wires. August Sundh, Yonkers, N. Y. Application filed March 28, 1899.

A flexible metallic casing consisting of a spirally wound overlapped strip, the overlapped margins of which are interlocked by an intermeshing rib of one side and a groove of the other.

630,636. Protective Casing for Electric Cables or Wires. August Sundh, Yonkers, N. Y. Application filed March 28, 1899.

The casing consists of a spirally wound overlapped metallic strip having spurs along one margin and recesses along the other margin, the recesses overlapping the spurs.

630,637. Protective Casing for Electric Cables or Wires. August Sundh, Yonkers, N. Y. Application filed March 28, 1899.

This casing is made up of an exterior coiled and overlapped strip, intermediate coiled-metallic strips of long pitch and an interior coiled strip.

630,667. Electric Switch. Henry H. Curtis, Springfield, Mass. Application filed November 5, 1898.

A switch is described having four upstanding tongues or contacts, two switch bars, each consisting of the sheet metal bent along its central longitudinal portion into U-form, providing opposing separate double blades, having for substantially their entire length the integral uniting and reinforcing back, the blades being pivoted at their one end to the contact members and having their opposite ends united by a cross bar of insulating material, and provided with a handle.

630,671. Electric Thermostat. Leonard H. Des Isles, Boston, Mass. Application filed September 2, 1898.

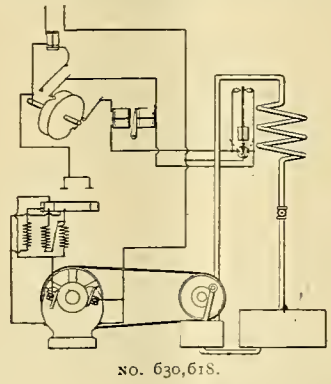
The thermostat has in combination a block to which are secured two electric contact points insulated from each other, a casing or cap secured to the block over the contacts, the casing having an opening therethrough having a bevel edge, a head or block having a spindle or stem with a bevel shoulder or dovetail end to project into the casing opening and secured to the casing in the opening by fusible metal, and a spring bearing on the head and the casing.

630,690. Process of Manufacturing Metallic Carbides. Herman L. Hartenstein, Bellaire, Ohio. Application filed March 7, 1898. Renewed December 23, 1898.

An improvement in the manufacture of metallic carbides, which consists in diffusing through molten slag as it comes from the furnace suitable proportions of carbonaceous material and limestone in a finely divided state, and then subjecting the mixture to the action of an electric current.

630,697. Electrical Conducting Main. John S. Highfield, St. Helens, and John M. Cater, London, England. Application filed May 16, 1899.

An underground electric conducting line is described, consisting of a series of dovetail-grooved metal bars each coated with suitable insulating material and having their dovetail grooves facing outward, wooden bars arranged between the metal bars and their dovetail grooves, and a metal pipe inclosing the bars and having an external groove extending opposite the dovetail grooves of the metal bars.



NO. 630,618.

630,714. Storage Battery. Charles W. Kennedy, Rutledge, Pa., assignor to the Electric Power Development company. Application filed April 13, 1898.

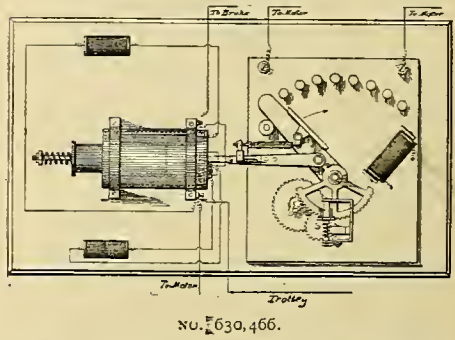
A storage battery consisting of a cell formed of hard rubber or non-conducting material having the upper flaring part and the lower approximately vertical-base portion formed with the lugs or thickened portions extending more or less outwardly, and the lugs or thickened portions extending inward, the lugs being adapted to give vertical support and lateral bracing for the bottom of the tray with relation to the one below and the one above it.

630,720. Storage Battery. Charles Lindenberger, Harry Lindenberger, and William B. Teal, Hannibal, Mo., assignors of one-third to Wilbert H. Cobb, Hannibal, Mo. Application filed March 1, 1899.

The battery has a battery case composed of sections fitted together and having within it a continuous perforated partition spaced apart from its walls and forming a chamber for the circulation of the electrolyte.

630,753. Storage Battery. William H. Smith, London, England. Application filed May 26, 1899.

The combination of plates or electrodes each comprising corrugated perforated retaining envelopes of non-conducting material having wide internal channels and narrow external channels, active material in the opposing wide channels thereof, conducting rods embedded in the active material, separating strips or struts between the electrodes fitted into the narrow channels thereof, and means to yieldingly hold the electrodes together.



NO. 630,466.

630,780. Overhead Trolley. Henry C. Loudermilch, Enders, Pa. Application filed December 10, 1898.

The wheel of the trolley has a central groove and shoulders or bosses arranged upon opposite sides thereof, the sides or edges of the shoulders being arranged in spiral or eccentric order and parallel with each other.

630,796. Method of Preparing Cathodes for Electro-deposition of Metals. Hermann Becker, Paris, France. Application filed May 3, 1898.

The method of obtaining by electrolytic deposition metallic articles having polished surfaces, and easily detachable from the cathode, which consists in preparing a cathode of any desired shape composed of silver or silvered metal, with a highly polished surface, then rubbing such surface with powdered sulphur, producing a polished surface of a sulphide of silver, and then depositing the desired metal upon the cathode by electrolysis.

630,797. Telephone. Henry F. Blackwell, Jr., and Maude A. Blackwell, New York, N. Y.; Henry F. Blackwell, Jr., assignor to Maude A. Blackwell. Application filed December 24, 1898.

The essential feature is a telephone receiver comprising a casing, a coil in the casing, a diaphragm, a metal core in the coil, a metal thimble surrounding the coil and connecting with the core, and a switch for controlling the primary of the instrument.

630,814. Automatic Electrical Gas-lighting Device. Svend M. Meyer, New York, N. Y., assignor of one-half to William H. Seidel, New York. Application filed June 23, 1898.

The combination of a gas-burner support, burner, gas cock, insulated plates carried thereby, incandescing member mounted on the burner, suitable conductors connecting the respective ends of the incandescing member with the key and its insulated plates, and gripping plates connected with the respective poles of a suitable source of electricity and adapted to make electrical connection with the key and insulated plate in turning on the gas.

630,827. Printing Telegraph, Frederick Hachman, Whitefish Bay, Wis., assignor to Henry L. Strohmeyer, Milwaukee, Wis., and the Printing Telegraph and Typewriter company. St. Paul, Minn. Application filed October 27, 1898.

One claim describes the combination of a revoluble wheel having type on its periphery, a rock shaft, an arm projecting radially from the rock shaft, a hammer in the free extremity of the arm adapted by the movement of the arm to be thrown against the type, paper-feeding rolls, a finger on the hammer arm adapted to rotate one of the feed rolls, an electromagnet, an armature in front of the electromagnet mounted on a swinging arm, and a rod connecting the free extremity of the swinging-armature arm to a crank on the rock shaft.

DESIGNS.

31,366. Battery Plate. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery company, Chicago, Ill. Application filed July 1, 1899. Term of patent seven years.

31,367. Battery Plate. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery company, Chicago, Ill. Application filed July 1, 1899. Term of patent seven years.

31,368. Battery Plate. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery company, Chicago, Ill. Application filed July 3, 1899. Term of patent seven years.

31,369. Frame for Electric-fan Motors. Robert Lundell, New York, N. Y., assignor of two-thirds to the Sprague Electric company, New York. Application filed July 16, 1898. Term of patent 14 years.

31,373. Rail Bond. William B. Cleveland, Cleveland, Ohio. Application filed May 31, 1899. Term of patent 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, AUGUST 26, 1899. No. 9

Electrical Equipment in Fish Bros.' Wagon Factory.

In the extensive factory of the Fish Bros. Wagon company at Racine, Wis., an interesting direct-current electrical power-transmission plant has been lately installed. It includes a number of multipolar steel motors, built by the Northern Electrical Manufacturing company of Madison, Wis., varying in size from 7½ to 50 horse power each and amounting in aggregate capacity to about 600 horse power. These motors drive the varied machinery of the factory. In the arrangement of the motor equipment such machines as require the most power and involve the greatest slippage of belts have been directly connected. Others of lighter power have been grouped upon various line-shafts, each shaft operated by one motor.

The motors derive their power from two dynamos of 125 kilowatts each (Fig. 3, page 116), driven at 350 revolutions per minute, mounted upon one base and operated by one shaft, but separable from each other by means of clutch couplings. These dynamos are operated by one large pulley located between them and driven from the pulley of a 400 horse power cross-compound Corliss Nordberg engine. This power plant is so constructed that either of the dynamos may be thrown out at will and at the same time a portion of the steam is cut off from the engine.

The electrical plant was designed and laid out by the engineers of the Northern Electrical Manufacturing company and the chief engineer and superintendent of the Fish Bros. Wagon company. The accompanying illustrations show its interesting features. A plan of the power plant, reproduced from a drawing made by the Manufacturers' Appraisal company of Milwaukee, is given on page 117. The main driving engine and the power generators are clearly shown in this drawing. Fig. 2 (page 116) shows the driving pulley of the main engine and the switchboard. Fig. 3 represents the two power generators on one base with the driven pulley between them. The group of illustrations on this page (Figs. 4 to 7) shows several motor applications. Fig. 4 illustrates a slow-speed motor with intermediate shaft driving a 24-inch cutoff saw. Fig. 5 represents a motor at the ceiling provided with two pulleys and an outboard bearing, driving two line-shafts, from which are operated a number of comparatively light-running machines. Fig. 6 shows a large motor direct-connected to exhaust fan for picking up shavings. Fig. 7 represents direct-connected motor operating a sticker machine. This machine had been very difficult to operate by shaft and belted drive on account of the slippage of belts when the sticks were put through the machine, but the introduction of electric drive on this machine eliminated this difficulty and increased the daily output by nearly 50 per cent.

It will be interesting, both to electricians and to power users generally, to note that Mr. J. H. Wright, the superintendent for the Fish Bros. company, states, over his own signature, that the electrical-transmission plant is satisfactory in every particular. In a letter to the Northern company Mr. Wright says:

"We find by actual running tests, extending over a period of about three months, that we are saving from 75 to 100 horse power. We were using with our belted transmission about 300 horse power. We are doing the same amount of work, and if anything, a little more, and we are using at present with the electrical transmission about 200 horse power, so that our estimate of 75 to 100 horse power is a very safe estimate. The saving will show more than this, undoubtedly, if you take into consideration such items as starting and stopping the different departments.

"We find, also, that there is a slight increase in the capacity of our machines. How much, we are not prepared to say at the present time, but we are quite confident that this item will amount to considerable, as we have noticed already on several of our large machines, such as a large ripsaw and a four-sided sticker, that are direct-connected, that the speed is so constant and positive that no time is lost on account of the slippage of belts. We also, where we have several of the smaller machines grouped together and operated by one motor, have

Fig. 4. Motor with Intermediate Shaft Driving 24-inch Saw.
Fig. 6. Direct-connected Fan for Picking up Shavings.

Fig. 5. Motor with Two Pulleys Driving Line Shafts.
Fig. 7. Motor Operating Four-head Sticker Machine.

ELECTRICAL EQUIPMENT IN FISH BROS.' WAGON FACTORY.

noticed particularly the same results. It seems to make no difference with the speed of the machines whether one is thrown in at a time or whether three or four machines are thrown in together.

"The motor works up to speed almost instantaneously, and, in fact, it seems the harder the machine is crowded the more positive the speed is. This is very noticeable to any one that bas had long experience in a factory equipped with belted transmission, and where the power is transmitted through several different belts the loss from slippage is very great. Another thing which we consider very favorable to the electrical transmission is that we were able to change over from our old power plant with belted transmission to the new power plant with electrical transmission without any loss of time. Our factory has been in constant operation during all of the changes. Of course, this would not amount to anything in erecting a new factory, but in equipping an old plant it is a very important factor to be able to put in a complete new power plant without any loss of time.

"The only criticism that we can make on our plant at present is that we did not put in more direct-connected motors and cut up our different departments into smaller groups. Of course, this would increase the expense of equipment, but we are quite positive that it would pay for the investment."

An enumeration of the various motors and the driven machinery will show the varied work accomplished.

A 7½ horse power, 1,025-revolution motor operates all the machines in the machine repair shop (see plan, Fig. 1), including two lathes, a 20 by 20 by four-inch planer, a drill press, two knife-grinding machines and an emery grinder. A 10 horse power, 1,000-revolution motor supplies the power for a large pendulum-swing cutoff saw. A 30 horse power, 975-revolution motor runs a large automatic-feed ripsaw. A 40 horse power, 975-revolution motor drives a 42-inch bandsaw, a 20-inch single surfacer, a 10-inch hand joiner, a ripsaw, an eight-inch joiner and a seven by 16-inch platform belt-hoist elevator.

A 30 horse power, 975-revolution motor runs a 30-inch double wood surfacer, a 26-inch scraper and a 24-inch self-feed edger. A 50 horse power, 1,150-revolution motor operates a 60-inch double Sturtevant exhaust fan. A 20 horse power, 650-revolution motor drives a pole shaper, a double-spindle shaper, a combination rip and cutoff saw and a double-spindle emery grinder.

One 40 horse power, 975-revolution motor drives a large number of machines. The list is as follows: Two power hammers, one of 25 pounds and the other of 50-pound capacity, a No. 3 Sturtevant exhaust fan, several emery grinders, two drill presses, a single punch and shears, three wood-mortising machines, an Invincible sander, a 36-inch bandsaw, a spoke-shaving machine, two double-spindle shapers, a three-inch double-head tenoning machine, a vertical boring machine, a combination sawing and relishing machine, a cutoff saw, a combination boring and sawing machine, a ripsaw, a 12-inch joiner, a pendulum-swing saw, a 26-inch single planer, two sanding-belt machines, a flexible boring machine, a disk sander, a grindstone and three small paint grinders. These machines are located on three floors.

Another 40 horse power, 975-revolution motor supplies power for a wood-turning lathe, a 24-inch single surfacer, a four-inch double-head tenoning machine, a six-spindle boring machine, a single-spindle wood-boring machine, a hollow-chisel mortising machine, a double-rotary disk and belt sander and axle-shaving machine, a skein fitter, a post axle-boring machine, a Williams-White skein press, a three-head gaining machine, four double-spindle shapers, a sticker molding machine, a 12-inch joiner and a cutoff saw.

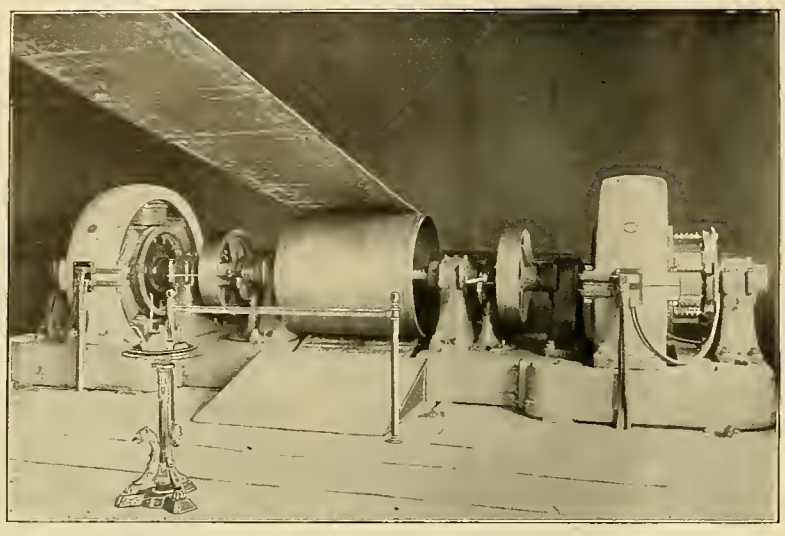


FIG. 3 ELECTRICAL EQUIPMENT IN FISH BROS.' WAGON FACTORY.—POWER GENERATORS.

One 15 horse power motor runs a dowel-cutting saw, an emery grinder, a Buffington & Forney combination spoke-tenoning and wheel-finishing machine and a double-spindle wheel sander.

A 30 horse power, 975-revolution motor runs a spoke-tenoning machine, a hub-finishing machine, a spoke-sawing machine, an 18-inch-belt spoke-sanding machine, a single-spindle spoke shaper, a 30-inch Sturtevant single-exhaust fan, a double-spindle shaper, a felloe-rounding machine, a double-head felloe dowel-saw machine and a vertical single-spindle iron-frame felloe-boring machine. Another 30 horse power motor drives a 24-inch joiner, a 20-inch pony planer, a two-side felloe planer, a felloe-cutoff machine, a rim-rounding machine, a drum sander and a rim sander.

In the iron-working department a 30 horse power, 800-revolution motor operates three drill presses, several emery grinders, a 35-inch Sturtevant exhaust fan, a "bulldozer," a pneumatic-power hammer, two cushion hammer, five punching and shearing machines, a six by 16-foot platform elevator, a band roll, two tire rolls, a box-strap roller, a tire-welding machine and a hub-mortising machine. A number of wood and iron-working machines in two adjoining buildings are driven by a 25 horse power, 500-revolution motor, which also operates a rope cable running over the tops of buildings a distance of nearly 200 feet, which cable operates several sewing machines and a cutoff saw. The machines operated are: A 30 and a 24-inch box-board sander, three cross-cut saws, a four-inch sticker, a 20-inch single-exhaust fan, two double-spindle shapers, a new Doty punch, a vertical drill press, two vertical tappers, an axle-turning lathe, a thread-cutting machine, bolt-pointing and threading machines, an emery grinder, nut-running and threading machines, a post-boring machine, a cutoff saw, and three sewing machines in the carriage-top department.

A 15 horse power, 650-revolution motor runs a belt-hoist elevator in the storehouse, with a platform seven feet six inches by 16 feet one inch in size. Finally, a 25 horse power, 575-revolution motor runs two lever feed-post drills, a suspended tire-drilling machine, hub-cupping and hub-boring machines, a box press, a bench emery grinder and a seven by nine-foot platform elevator.

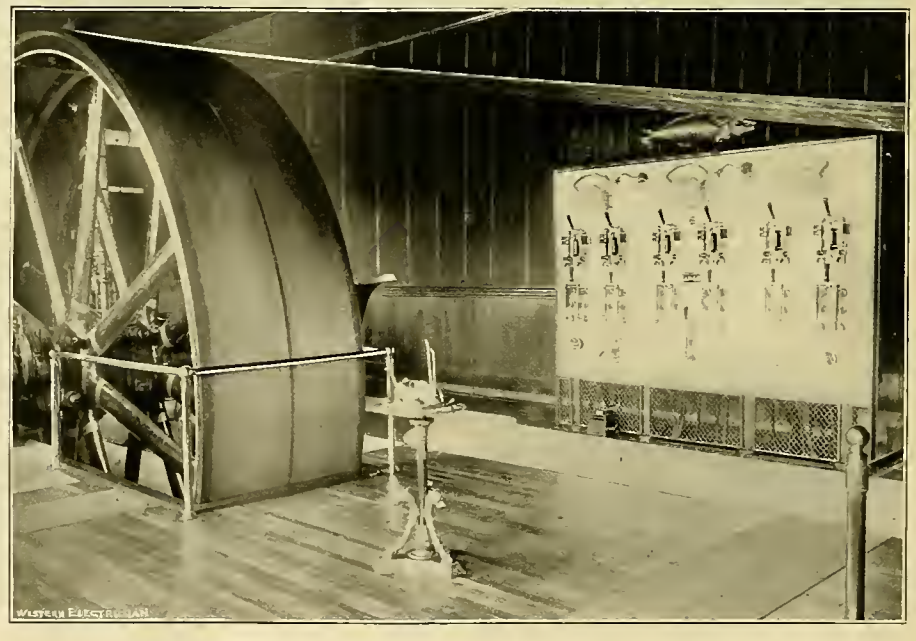


FIG. 2. ELECTRICAL EQUIPMENT IN FISH BROS.' WAGON FACTORY —MAIN ENGINE AND SWITCHBOARD.

Affairs of the Chicago Edison Company.

There is a possibility that an alliance of traction, electric-light and automobile interests may be effected in Chicago in a manner similar to the accomplishments in New York and Brooklyn. The "Whitney crowd" of New York and Philadelphia now controls the North and West Side surface-railway systems and the Illinois Electric Vehicle Transportation company. Samuel Insull is president of the latter company and also of the Chicago Edison and Commonwealth Electric companies. It is rumored that the eastern syndicate may purchase the electric-light companies and organize a new company, capitalized at, say, $25,000,000, to combine their business with that of the automobile company. Such a company would have the same ownership as the Chicago Union Traction company and would, of course, be closely affiliated with it. The plan discussed contemplates a four per cent. bond issue by the proposed company, these bonds to be exchanged for the present Edison stock at two for one, with an additional bonus of the stock of the new company equal to 50 per cent. of the face value of the present Edison holdings. However, the deal is far from completed at present, although it is said that negotiations have been under way for months.

The Chicago Inter Ocean describes the situation in these words: "The situation which confronted the Chicago Edison stockholders was that of a powerful syndicate, which came to Chicago with the intention of pursuing the same course here that it has pursued in New York, Brooklyn and Philadelphia, where it controls the electric-lighting properties as well as the street railroads. The Chicago Edison people had the simple alternative of selling out or getting into a ruinous fight with a corporation which produces in Chicago a great deal more electricity than does the Edison company. Indeed, the ability of the former in that respect is such that by eventual development of its plant it will be able to furnish all the current now furnished by the Edison company without the use of a degree of plant capacity equal to that owned by the Edison. In other words, the syndicate is in a position to supply its own wants and furnish as surplus current an amount equal to the output of the Edison. The syndicate was also able to have its own way.

"There is still another interesting phase. The Illinois Electric Vehicle Transportation company is owned by the same traction syndicate. The Edison people believed they would be called upon to furnish current for the electric vehicles. So, doubtless, they would if things had gone on in statu quo. But when it was seen that the syndicate wanted peaceably to acquire the Edison properties, the owners of the latter saw readily enough it was either make terms or fight."

The Hooker Stranded.

Manila advices of recent date are to the effect that the United States cable ship Hooker is fast aground in the north channel off Corregidor Island. The accident is ascribed to an error of the navigating officer. When she went ashore the Hooker had on board about 550 tons of cable (about 212 miles) and the cable-laying machinery. The cable and appliances were taken off, but the ship was still aground at the last report.

Electricity in Coal Mining.[1]

By John Price Jackson and Frank F. Thompson.

The statements in this short paper on the use of electricity in mines refer especially to the mining of soft coal. Of the essential elements in operating such mines, two of the most important are: First, apparatus to obtain efficiently the rapid handling of the coal; and, second, to do this with the least possible number of openings. These conditions have evidently been large factors in causing the application of electricity to such operations.

The applications of power to mines which we wish to consider are principally for (a) lighting, (b) haulage, (c) cutting or drilling, (d) pumping and driving fans.

Systems.—The systems worth considering which are in use at present may be tabulated as follows:

1. Rope haulage, and steam for all other purposes.
2. Electric haulage, and compressed air for other purposes.
3. Electric haulage, and electricity for other purposes.

Various other combinations are, of course, used, but these three will serve the purpose, as representing well-defined types.

Rope Haulage and Steam Power.—In the past this system has been the standard, and even yet in many portions of the hard-coal fields has a very firm hold. Experience has shown rope haulage much inferior to electricity, in point of working economy, as is now being illustrated by the continual substitution of electric for rope haulage now going on in the soft-coal field.

The Mitchell Coal and Coke company had two mines running for some time at Gallitzen, Pa., under exactly similar circumstances, but one using rope, the other electric haulage. It was quickly proven that the electric was far preferable.

Steam power for pumps and fans in the mines has likewise been shown by experience to have many faults. Timbers along which the pipes pass rapidly deteriorate. The piping is expensive to install, and can only be kept in good condition by constant attention. If the lines are long they are a source of large loss of power by radiation and condensation, even when well covered. They are a nuisance in the mines, because of their high temperature. The steam motors are expensive from the standpoint of repairs and attention. Steam cutting and drilling will in most cases prove unwieldly. Mines operated under this system are without suitable means of lighting, an important matter in rapid operations.

Electric Haulage and Compressed-air Power.—The Berwind-White company's mines at Windber, Pa., furnish an excellent example of this system, and, so far as known, it has given complete satisfaction. This plant, which has now six mines in operation with an output capacity of 5,000 tons per day, is eventually to be increased to 10 mines with 10,000 tons capacity. The haulage in the mines is done by electricity, while the drills, interior pumps and fans are driven by compressed air. The use of compressed air has many obvious advantages. It is found that the machinery, working under the extremely severe conditions to be found in a mine, performs its duty well. It requires little attention and is thoroughly reliable. On the other hand, pipe lines in extended mines are expensive to lay and keep in repair. The pipes soon deteriorate, and when the lines are removed from old workings it is usually found that much if not all the pipe is in too bad shape for further use.

The flexibility of the system or its adaptability to quick changes is not satisfactory.

Electric Haulage and Power.—For convenience in discussion this head may be divided into two sub-systems, as follows:

(a) Direct currents for haulage and other power.

(b) Direct currents for haulage and polyphase currents for other power.

The use of direct-current machinery for pumping and fans has not been found satisfactory in many instances. One large company, after a thorough trial of such apparatus, rejected it in favor of compressed air. The pumps in a mine are subject to only rare inspection, and that, oftentimes, by unskilled workmen. These conditions, combined with the unfavorable location of the machinery, will soon cause electrical troubles in the commutator, or elsewhere, of the most carefully constructed motor. Inasmuch as the stopping of a pump, even for a short time, may cause excessive damage, the use of such a motor is a constant menace.

The second electric system, that using direct and polyphase currents, has the inherent disadvantage of requiring the installation of two distinct and separate sets of generators and wiring. That is a matter of serious importance, as will be indicated later, but is neither so expensive nor cumbersome as the piping used for compressed air. The great advantage in the use of polyphase currents lies in the fact that they permit the use of a motor that is perfectly reliable under essentially all conditions of operation to be met with in mining. This compound electric system seems without doubt to be the best that can be installed for large operations. It comprises the advantages of all the other systems, while eliminating their most serious defects. A system using polyphase currents alone might possibly prove more advantageous, but would have the serious defect of requiring two trolley wires, and even if this difficulty were overcome, it would have to await the development of a polyphase motor suitable for a mining locomotive.

The Davis Coal and Coke Company.—The Davis Coal and Coke company's plant at Thomas, W. Va., is so efficiently equipped with this compound electric service as to be worthy of a short description. The company operates two mines at Thomas, the Thomas drift and the Davis shaft, and one mine at Coketon, a drift.

The power station is a roomy brick building, containing Ames 200 horse power engine, direct-connected to a 150-kilowatt, 500-volt, direct-current generator; two Atlas cycloidal heavy-duty engines of 150 horse power, one of which is belted to a 100-kilowatt, 550-volt, three-phase alternator, and the other to a 75-kilowatt, 550-volt, direct-current generator. The last-mentioned generator has been installed temporarily in the place of a second 100-kilowatt, three-phase, 550-volt alternator, which had been operated in parallel with the other three-phase alternator. This 75-kilowatt machine is used to help the haulage generator.

The coal is hauled by horses from the "rooms" to convenient points, where it is collected into "trips" of from six to 12 "wagons." The inside-haulage motor, a 14-ton electric locomotive, takes these "trips" and hauls them to a central point of the breast, and there they are combined into larger "trips" of about 15 to 35 wagons, and hauled to the mouth of the mine by another similar motor. Each of the haulage motors gives 3,500 pounds, draw-bar pull. At Coketon, two miles away, another 14-ton haulage motor is installed.

The alternating three-phase generator is used for operating three 10 horse power induction motors for driving small pumps, one five horse power, one 10 horse power, two 20 horse power and one 30 horse power induction motors for operating elevators; one five horse power induction motor for a car lift, and three General Electric chain coal cutters. The induction motors for driving the pumps are located at the foot of the side entrance, both at Thomas and Coketon. One 10 horse power induction motor, connected to a pump having a five-inch suction 250 feet long, and a four-inch discharge pipe 750 feet long, with a total elevation of 28 feet, pumping 106 gallons per minute, was tested and found to take 11,000 watts. Induction motors are also used for driving fans and conveyors, which carry the slack coal from beneath the screens to the bins, where it is stored until needed to charge the coke ovens.

Haulage.—Electric-haulage equipments have been so long in use as to be now in a thoroughly good state of development. Even yet, however, the following faults may be observed in some of the machinery: Poorly acting brakes, unwieldy arrangement of the various controlling levers and trolley poles, brake rods or other projections too close to the track, and unsatisfactory speed and power regulation. Although some of these seem of small importance, any one of them is apt to seriously interfere with efficient work. The brakes on a mining locomotive should be very powerful and quick acting; likewise, the arrangement of motorman's seat, brake handle, controller and sand-box lever should be such that the motorman can control his machine with the greatest possible dispatch and ease. Locomotives have been placed in mines with absolutely no provision for the motorman, and others where the lever arrangements are so unwieldy as to make the quick control necessary to safe operation impossible. In large coal operations economy is often to a large extent dependent upon the rapidity with which the wagon trains can be moved. Heavy grades, both in favor of and against the load, are frequently to be found. In order to draw a large load and make quick time, the design and control of the motor should be such as to give an unusually great draw-bar pull at low speed, and at the same time have points of comparatively high speed. This condition is not properly met at present by all of the mining locomotives in operation. In one mine, which has come recently under the writer's observation, a slightly different design and arrangement of control in the locomotive would permit the handling of much larger loads at a great saving.

The power-house load curves or haulage are naturally very similar to those of other electric-railway work. Fig. 1 (p. 118) shows curves for three stations. Curve No. 1 was taken at the Davis Coal and Coke company's mine at Thomas, W. Va.; two 14-ton locomotives of 70 horse power were in service, hauling the regular output, which in this case amounted to about 1,300 tons per day. Curve No. 2 was taken

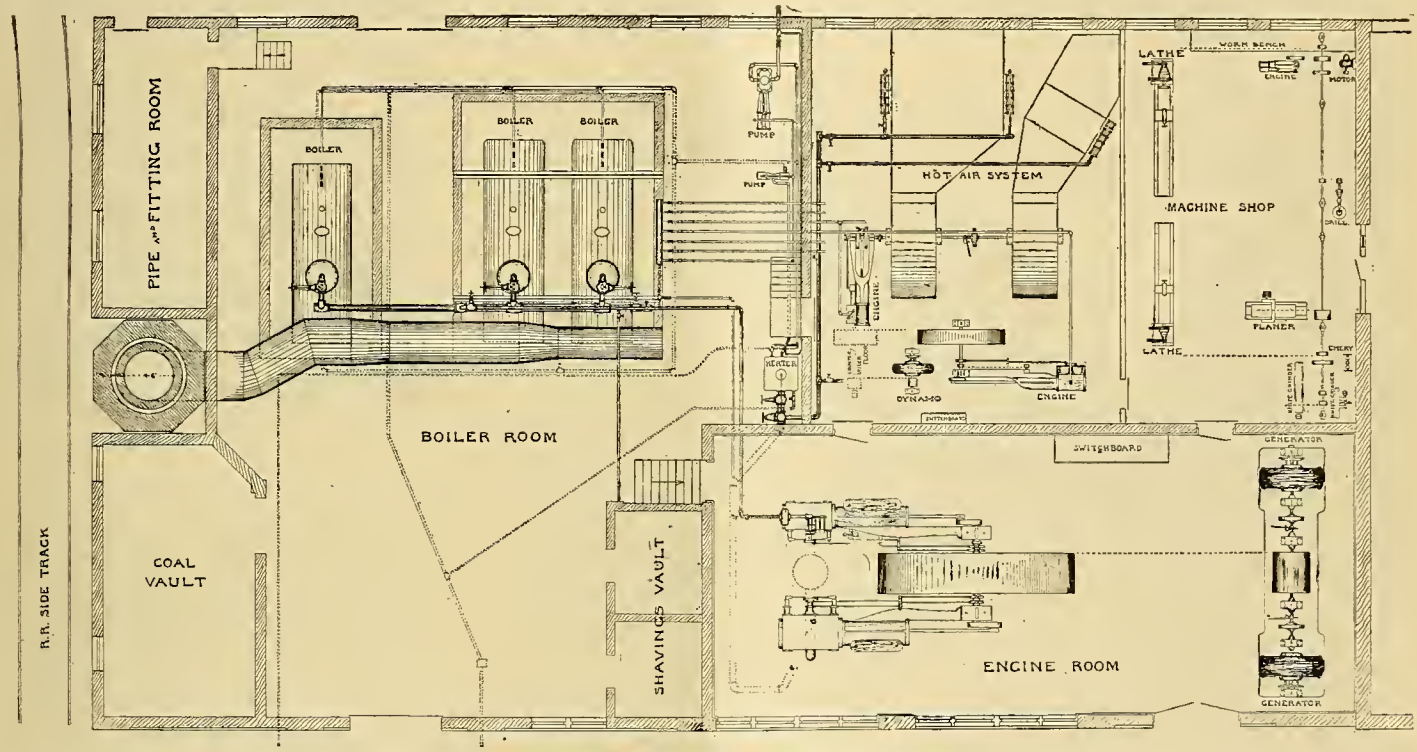


FIG. 1. ELECTRICAL EQUIPMENT IN FISH BROS.' WAGON FACTORY.—PLAN OF POWER PLANT. (SEE PAGE 115)

1. Presented at the general meeting of the American Institute of Electrical Engineers, Boston, June 27, 1899.

at the Berwind-White company's mines at Windber, Pa. Five locomotives of 12 and 20 tons are installed in this mine. Curve No. 3 was taken at the Davis Coal company's mine at Coketon, Va. One motor of 14 tons was operating at the time.

Coal Cutting.—Under suitable conditions, undercut coal cutters will permit a great saving of labor, and, therefore, of expense, in soft-coal mining. But in a large number of cases such cutters have been thrown out as unsatisfactory, and have been replaced by compressed-air drills or other apparatus. In mines where curve veins abound they have ordinarily given much trouble. The cutter strikes the clay vein and sticks, or, worse, bends, causing it to

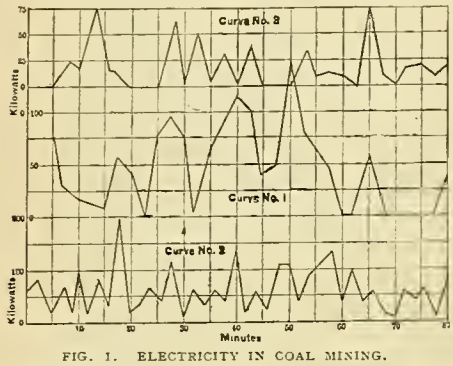


FIG. 1. ELECTRICITY IN COAL MINING.

wedge tightly. This necessitates digging out with the pickax and expensive repairs. The most serious difficulty seems to arise from poor mechanical design and construction, combined sometimes with electrical faults. It should be possible to overcome these difficulties. In one mine, where great trouble of this nature was previously experienced, a new set of machines is now giving great satisfaction.

Fig. 2 gives the power curve of a 20 horse power cutter working in the mines at Gallitzen, Pa. In cases when under-cutters cannot be made to work, there seems no valid reason why electric drills could not be substituted, which would give as good service as compressed air, while at the same time preserving the valuable advantage of an all-electrical plant.

Electric Pumps.—Electric pumps run by induction motors give very satisfactory service. The conditions met with in mining often necessitate frequent relocation of the pumps, and in this respect the electric pump is by far the most satisfactory. The attention required is certainly a minimum. A particular pump tested ran about 10 hours per day, and the only attention required was that necessary for starting, stopping and lubrication. Some mine owners have objected seriously to the electric pumps. In most cases these objections have been due to the compact arrangement of the pump and motor. In one mine which came under our observation a 10 horse power pump which was bought with the motor was replaced by the water end of a steam pump, with a great improvement in the service. If electric motors were made to suit the pumps, and not the pumps to suit the motors, it would go far toward obviating the most serious objections. When the pump must be of large capacity, and when it can be located within a reasonable distance of the steam plant, a steam pump would probably show greater economy.

Wiring and Pressure.—Wiring in mines is subject

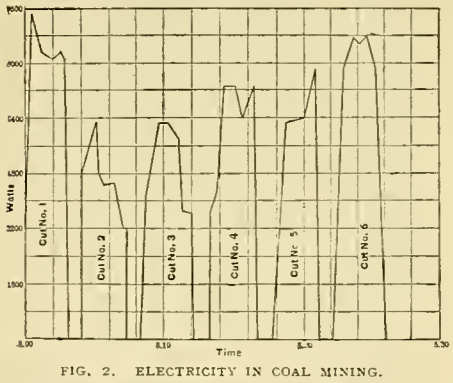


FIG. 2. ELECTRICITY IN COAL MINING.

to certain restrictions, which do not apply in ordinary wiring. There is no doubt that the 550 volts used for haulage is dangerous for horses. It is therefore customary in many mines to shut off the trolley current while the mules are being taken in or out of the mines. If a polyphase system is installed for operating cutters, pumps, etc., in the mine it should be run through the air courses, and not through the main gangway. A pressure of 550 volts alternating is much more dangerous than the same direct-current pressure. The class of labor which is usually employed in the soft-coal fields is of a low grade of intelligence, and many instances are recorded of serious personal injury or loss of life from accidental or intentional contact with the wires on both 500-volt alternating-current and direct-current service. Although the mine laborers may have been repeatedly warned of the danger, they continue careless about the wires. When the mine roof is low enough to be reached by the men the common practice is to run trolley wire along one side, supported by the usual hangers. When feeders are necessary they should be run along the same side. The other side of the roof should be kept clear.

Ordinary bare wire is preferable in mine work. The best insulation, rubber compounds, deteriorate rapidly under the action of the sulphur water. Any other insulation soon becomes inefficient, owing to the moisture, which is always present in a mine.

In large operations, such as those at Windber, where 20 miles of trolley are already in service, it is undoubtedly advisable to use at least 500 volts pressure for haulage. The polyphase power should preferably be used at a lower pressure for the sake of safety to employes. This could often be done without an undue expenditure of copper, by carrying high-pressure lines overhead to air ducts, or through unused passages to suitable points for distribution, where the pressure could be lowered by transformers. When it is necessary to run wires down a shaft through which coal is to be hoisted, the best practice would be either to use lead-covered cable or wire which has been insulated with rubber, heavily braided, and drawn into an iron conduit having the ends hermetically sealed. In many instances when wires have been installed without such protection, in old shafts, trouble has resulted from the breaking of the wires, caused by lumps of coal falling down the shaft, etc.

Skilled Employes.—Too much pains cannot be taken to employ careful men as motormen for the haulage motors. The mine track is far from being up to the street-railway standard. To haul a long trip of wagons over a bad track requires careful handling of the motor. The motorman should be trained to study his track and his load, and know when and where to let his trip run slack and where to keep the couplings taut. A case came under the writer's observation where a careful motorman handled a trip of 15 loaded wagons, while another motorman stalled with 10 wagons on the same stretch of track. This matter is a very important one from the mine-owners' point of view. The cost of driving gangways and shafts is considerable, and any method that will allow of an increase in the quantity of coal which can be taken from a single opening in a given time adds very materially to the mine-owners' profits.

Lighting and Signals.—As the lighting of a mine is a comparatively simple matter, it is scarcely necessary to consider it here. The universal method is to light up all switch points, and only other places of exceptional importance. In large mines, using a number of locomotives, an efficient system of signals should be used in the main headings. This should be an automatic block system. Mr. A. S. McAlister of Windber, Pa., has worked out such a system, using incandescent lamps between trolley and rails, which is working admirably.

Efficiency.—The question of efficiency, from a fuel standpoint, is of comparatively small relative value, as the difference in actual cost in fuel in the different systems is insignificant, when compared with other expenses. Data available seem to indicate, however, that the all-electric systems lead in this respect. As regards the total commercial efficiency, including maintenance, labor, interest and depreciation, there can be no doubt but that the compound electric system, using polyphase and direct currents, will give the best results.

General.—The data and statements presented in this short paper are gathered from personal experience in the mines, from mine superintendents and from student-thesis work carried on under the supervision of the Pennsylvania State College. In writing the paper, it was not intended to give a complete detailed treatise on the use of electricity in mines, but to outline the most important conditions and facts bearing upon such utilizations.

Philadelphia Exposition.

The main building of the National Export Exposition at Philadelphia was formally turned over to the exposition managers by the contractor last week. The structure is completed with the exception of a little exterior work. The work on all the exhibition buildings is so far advanced that the early installation of the exhibits is possible, and it is believed that everything will be in place on the opening day, September 14th. A convention hall is to be constructed on the second floor of the north pavilion of the main building for the accommodation of organizations which will not require the extensive facilities of the Auditorium. The exercises of Franklin Institute's seventy-fifth anniversary will probably be held in part of this hall. It will seat about 1,000 people.

The plant of the Roanoke (Va.) Street Railway and Electric Light and Power company has been bought by Major R. M. Venable of Baltimore.

The Diatto Electric Railway.

In Europe several municipalities have been weighing the advantages and disadvantages of the trolley system of street-car service when compared with the many systems of underground distribution; and the latter seem to be gradually but surely overcoming the objections urged against them.

One of the sub-surface systems, named for its inventor, Diatto, has recently come into use in the city of Tours, France, and as this is in many particulars radically different from most underground systems, a short description, condensed from l'Energie Electrique, should be interesting to the readers of the Western Electrician.

There is a series of contact plates, and an interrupter is placed beneath each one, these plates being located at short intervals between the rails. This interrupter is in the form of a headed bolt of iron, plunging in a vessel containing mercury, the latter in contact with the underground source of current.

Beneath each car is suspended a bar magnet, which passes successively over each of the bolt heads,

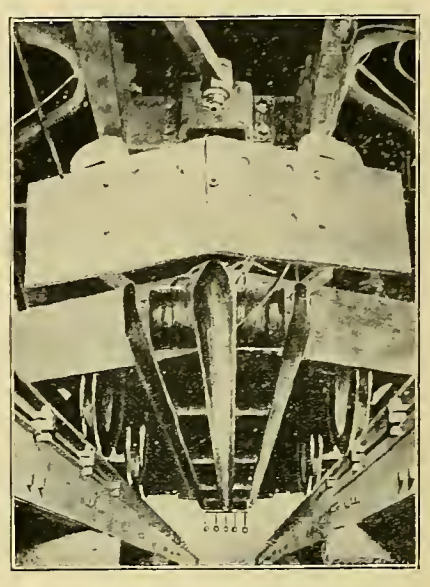


FIG. 3. DIATTO ELECTRIC RAILWAY.—VIEW UNDER CAR.

drawing them upward, but not entirely out of the mercury, thus forming a circuit to the motor which actuates the car.

The bar is longer than the distance between the contact plates, so that there is no break in the continuity of contact. These plates are about 20 millimeters (0.8 inch) above the level of the track.

Reference to Fig. 1 will aid in understanding the mechanism, shown in section. The block (S) surrounding the contact plate is of asphalt, the center being open and resting on a concrete tubing (P). These blocks, as well as the road proper, have a foundation of beton, and between the rails the blocks are bedded in cement and treated to a coating of asphaltum with an inclination sufficient to drain away the surface water.

The blocks have each a removable rim of non-magnetic metal, which surrounds the contact plate, and is bolted to a bronze frame permanently embedded in the block, as shown at (E).

A piece of cast-iron (M) of great magnetic permeability is permanently fixed in the mass of the block, supporting a cross-piece (L), also of cast-iron, the middle of which in form of a socket permits the insertion of the piece (J) which makes contact with the cup of mercury below. The lower part of this cup has a metal stopper, from which leads a copper wire connecting to the cable (Q).

FIG. 2. DIATTO ELECTRIC RAILWAY.—MAGNETIC CONTACT BARS.

The cup is of ebonite, and in the mercury contained therein the iron bolt (K) rests. The weight of the bolt and the quantity of mercury are so proportioned that the former when inactive is lightly balanced, so that a very slight attraction will raise it and form contact through the plate above it. The contacts on the bolt and the plate, coming into use when the former is attracted, are of very hard carbon, the two surfaces being thus surer of good contact.

The bar magnet (Figs. 2 and 3) is made up of three bars, the center being of one polarity, while the two outside bars are of the opposite polarity, the electromagnets shown being so connected as to produce this result.

Each of these electromagnets has two windings, both in the same direction. In the normal condition of affairs the magnets are actuated by the station current, but if from any cause this circuit

is broken, or at the moment of starting, a second current from an accumulator battery does the work. This battery occupies a space of 85 by 35 by 38 centimeters, and develops 5.5 to six amperes at an electromotive force of 30 to 32 volts.

The carbon contacts are prevented from arcing by the fact that the magnetic influence holds the bolt attracted until a subsequent contact is made, when, the current having now a second or third contact, the bolt drops back without the least sparking. The compressibility of the carbon insures a perfect contact under all conditions.

The head of the bolt deserves special mention. It is formed of a cone of graphitic carbon, extremely pure, perfectly homogeneous, and so dense as to admit of perfect turning and to be susceptible of a beautiful polish. The corresponding contact be-

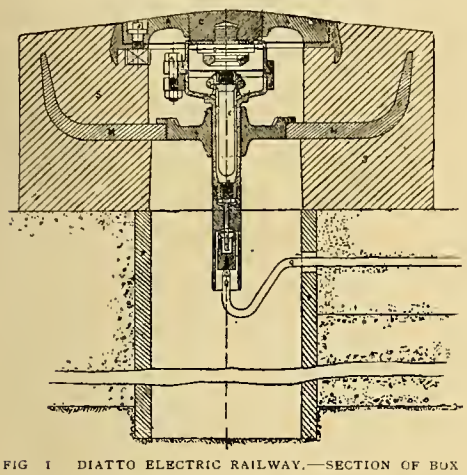


FIG 1 DIATTO ELECTRIC RAILWAY.—SECTION OF BOX

neath the block is a cup, of the same material, formed to perfectly fit when receiving the bolt of carbon, thus making a nearly perfect contact.

The current of the battery, circulating through the electromagnetic coils, as has been stated, magnetizes the outer bars of one polarity and the central bar of the other. The magnetic circuit is completed through the wings of the piece (M), Fig. 1, over which the outer bars pass across (L) and to the bolt, which is strongly attracted to the block (C). This, given as the theory, has been vindicated by actual experiment, and shown to very materially increase the magnetic pull of the coils shown in Fig. 2.

In order to enable them to pass readily on the various routes through the city the cars are furnished with overhead trolley apparatus, a switch

FIG. 5. DIATTO ELECTRIC RAILWAY.—CHANGING A BLOCK

serving to instantly change from the one system to the other.

Fig. 4 gives a general view of the line, while Fig. 5 shows the ease with which a block may be changed.

The first practical test of the third-rail system for hauling regular passenger trains has been made on the Plymouth division of the New York, New Haven and Hartford railway, between Braintree and Cohasset, Mass., 12 miles apart. Regular passenger trains brought from Boston by locomotives were attached at Braintree to the regular double-motor cars that have been used on the Nantasket Beach branch for the last four years. The trial is said to have resulted successfully.

The Omaha Fatality.

Further details of the accident at Omaha by which four firemen lost their lives by electric shock through an extension ladder used at a fire show that it is difficult to trace the fatal current to its source. The ladder used by the firemen came in contact with only three wires. One was a 2,000-volt primary, alternating-current wire; the second was a 9.6-ampere series, direct-current arc-light wire, and the third wire was one of the outside wires of a three-wire secondary system carrying 106-212 volts. The primary circuit was used for supplying two theaters only, and, as the accident occurred after the matinee held that day, the circuit was undoubtedly dead, the double-pole switch on the switchboard having been pulled. The arc circuit was for supplying municipal street lights, and it is believed that there was not a single arc machine running in the city at the time of the accident. The third wire was the outside wire of a three-wire secondary system, of which the neutral wire was grounded, so that it would seem impossible to have received more than 106 volts.

The ladder had been in contact with the primary wire, but at the instant of the accident was not, as far as known, in contact with this wire. There seems to be reason to believe that the fatal current was received from the three-wire secondary, and yet, as before stated, the neutral was grounded. Further than that, thorough tests made after the accident showed that there were no crosses with other circuits and no grounds on any of the three wires touched by the ladder.

As to the line construction at that point, it is stated that the construction was absolutely modern,

FIG. 4 DIATTO ELECTRIC RAILWAY.—GENERAL VIEW OF THE LINE.

of the best possible type and in excellent condition. The wires all had triple-braided weatherproof insulation, and the insulation was in as good condition as new. The iron edges of the ladder cut through the insulation.

Bridgeport Motorman Said to Be Criminally Careless.

The coroner's jury on the trolley-car disaster at Peck's Mill Pond, near Bridgeport, Conn., rendered its verdict on Thursday of last week. Governor Lounsbury is called upon to convene the Legislature for the enactment of laws requiring the licensing of motormen, establishing a trolley-railroad commission, the reduction of the working hours of motormen and the use of both inner and outer guard rails on bridges. George S. Hamilton, the motorman, was found guilty of criminal carelessness. The Shelton Street Railway company was found guilty of negligence in not keeping the approaches to the bridge in good condition and in not enforcing its orders for moderate speed.

One of the witnesses in the last days of the inquest admitted that he removed a fuse from the wrecked car the day after the accident occurred. He said that he was an employe of the Bridgeport Traction company, and that when he was at the scene of the accident he saw the fuse in the car, and, thinking that some person might remove it and make away with it, he decided to take it. He thought it might be of use to his employers in proving that the car was in good condition and that the absence of a fuse was not responsible for the inability of the motorman to stop the car. The fuse was produced, and, after an examination by an electrician, was pronounced to be in good condition.

Power from Chicago Drainage Canal.

A special committee was appointed by the Civic Federation of Chicago a short time ago to investigate the value and availability of water power that could be developed from the drainage canal to connect the Chicago and Illinois rivers, now nearly completed. In the committee's report, which has now been presented, strong arguments are made against the leasing at the present time of the power to any private person or corporation for a long period of years. No express recommendations are made on the subject, but the general tenor of the report is in favor of the direct use of the power by the city of Chicago for municipal purposes. The committee has made a thorough examination of the subject, having secured testimony as to the actual working of the development of the water power at Niagara Falls, and has come to the conclusion that the power to be developed in the drainage channel would amount to about 20,000 horse power at Lockport, or, with the loss in transmission, 16,000 in Chicago.

In discussing the value of the water power to the city the committee reports as follows:

The drainage board has about 20,000 horse power net at its disposal even when the channel carries only the minimum quantity of water required by law. This power could be furnished continuously night and day. Converted into electricity and conducted to centers of distribution in Chicago, this would yield over 16,000 horse power at the sub-stations, which is more than enough to light the entire city of Chicago by maintaining an electric lamp at every street corner in the improved portions of the city. For that purpose about 16,000 lamps would be required, consuming not over 14,000 horse power. From practical tests that have been made it is concluded that the actual cost of producing this power by steam during the hours of night could not be reduced below $30 per horse power. The cost at which the water power of the canal would be delivered in Chicago is much less. The dams and races could be built for $1,200,000, and a further outlay of $1,500,000 would be required for the construction of the works necessary to convert the power into electricity, conduct it to Chicago and distribute it to consumers. These items give a total capitalization of $2,700,000, upon which interest must be computed at 4 per cent. as a fixed charge. Making a proper allowance for depreciation and repairs, and adding the expenses of operation, we find that $15 would cover the cost per horse power delivered at the sub-stations, and that the city could save money even if it had to pay out of its own treasury the total cost of development and a rental of $12 per horse power net besides. This item of $12 corresponds substantially to the offer of $5 per horse power which was recently before the drainage board for consideration.

In an appendix to the report, Francis B. Badt, the Chicago electrical engineer, gives the subject much attention. He presents a detailed account, showing the amount of power that should be available between Joliet and Lockport, and estimating the efficiencies and transmission losses in conducting the power to the city. Allowing a line loss of 15 per cent., Mr. Badt estimates that 16,245 horse power could be transmitted to sub-stations in Chicago.

The report concludes as follows: "Your committee is firmly convinced that no disposition of the water power should be made to private parties at the present time, but that its full value, whatever that may be, should be preserved for the taxpayers of the city and sanitary district. This value for a period of 50 years, according to conservative estimates, based upon experience in other localities and upon the opinions of the most competent electrical engineers, would amount to from $30,000,000 to $50,000,000."

The incorporators of the Allentown and Coopersburg Street Railway company, capitalized at $50,000, to build an electric railway from Allentown to Coopersburg, Pa., are W. J. Saeger, J. L. Schwartz, P. F. Connor, J. W. Crader and H. E. Crilly of Allentown.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office: 148 Times Building, New York.

Trade Supplied by Western News Co.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

New York State Electrical Contractors' association, Buffalo, N. Y., August 29th.

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

New York State Street Railway association, Ithaca, September 12th and 13th.

Old-time Telegraphers' association and United States Military Telegraph Corps, Copley Square Hotel, Boston, September 12th to 14th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

Pennsylvania Street Railway association, Stevens House, Lancaster, Pa., October 4th and 5th.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

Mr. J. G. Stowe, the United States consul-general at Cape Town, recently made a tour of South Africa. In his report to the government this is the closing paragraph:

"I must make mention of the electric-light and telephone plants seen on the trip. At Kimberley the service is American and is good. At Johannesburg it is Dutch and everyone is finding fault; no service is furnished after 5 p. m., and you must pay a year's subscription in advance—about $75 per month. In Durban it is German and fair."

It is certainly asking much to require a customer to pay for a year's service in advance, and then give him no light or telephone connections, whichever is meant—perhaps both—after five o'clock in the afternoon. An alleged electric-lighting service that is shut down at 5 p. m. has a marked resemblance to an attempt to give the play of "Hamlet" with Hamlet left out. Perhaps Mr. Stowe is a little mixed in his facts, but if he is right it is easy to see that at least one of the Uitlanders' grievances is a very real one.

After an expenditure of about $14,000,000 the Central London railway is now fast nearing completion. This railway is run through tunnels from 50 to 80 feet under the heart of London. It is to be electrically operated, and large electric elevators, capable of carrying 100 persons, will be installed at the stations. Several members of the board of directors traversed from one end of the road to the other, over the permanent rails, within a month. They found, they say, that the atmosphere was really enjoyable; in fact, far more pleasant than the upper surface. There was ample ventilation, and those who had been at work below for months said that it is in the same good state all the year round. It is pleasanter in the winter because it is rather warmer than the atmosphere above, and in summer it is cooler. The track is very substantially constructed of 100-pound rails laid on ties embedded in concrete, as the difficulty of repairs in a deep-tunnel road is obvious. The system has been carefully planned, and when it is put in operation it will be a notable addition to the efforts that are making to solve the rapid-transit problem in large cities.

In a letter describing the street-railway system of Glasgow, Mr. Ford, an American journalist, remarks that "Scotch caution and prudence have characterized the corporation's management of the tramways from the outset." This is true to an almost painful degree, as the correspondent himself shows. "After an exhaustive investigation of every known method of mechanical traction," he writes, "the Town Council decided that the overhead-electric system was applicable to every section of the city. A power station was established, and two routes, with a combined mileage of three and a quarter, are now operated by electricity, with single and double-decked cars. A third line, from Glasgow Cross, will speedily be converted into an electric road. Within six or eight years horses will be entirely displaced, and the tramway system, now having a total mileage of 41, will be operated by overhead wires." Think of it! Within "six or eight years" a street-railway system of 41 miles will be entirely equipped for electrical operation, a power house and two short lines being now in operation. That is "caution and prudence" with a vengeance. If the city officials have satisfied themselves that the overhead system is what they want, why don't they execute the work in six months, rather than six years? Having put their hands to the plow, the managers of the Glasgow corporation should not dawdle at their work.

In the course of a report to a committee of the ruling body of the Manchester (England) Municipal Technical Schools, Dr. J. T. Nicholson, head of the engineering department, recently made some interesting observations on technical schools and engineering works in America. What most struck Dr. Nicholson was the close practical bearing which the instruction, and especially the experimental department, had upon every-day engineering work. In all cases the professors and teachers were in the closest relation with practicing engineers. The professors also have large influence with the employers of their districts in securing positions for the students. Dr. Nicholson states that it is believed that this spirit of mutual helpfulness on the part of the technical schools and the manufacturers (which is so marked a feature in America and in Germany) would be of great assistance in the industrial development of England. When technical schools and institutions are in a position to construct apparatus and carry on researches on questions of immediate interest they are in a position to justify an important relation to the industrial and commercial progress of the country. Such justification had long been admitted in America and Germany, with results not wholly satisfactory to British trade.

Dr. Nicholson did, indeed, hit upon one of the reasons for the usefulness of the American technical schools—insistence on practical work of every-day, commercial value, although not to the exclusion of drill in scientific theory and investigation, on which the practical work of to-morrow will be based. The class-room, the laboratory and the workshop are all necessary for the training of the student, and it is the advantage of the best American schools that work in none of them is neglected.

Slowly but surely the conviction seems to be growing in the minds of the managers of the great steam-railroad systems that they must make use of the economical transmission of power afforded by electricity or else abandon much of their local business to the various electric-railway companies with which every trunk-line system now finds itself, to some extent, in competition. The electric cars offer travelers between neighboring towns a pleasanter ride than the coaches drawn behind steam locomotives, especially in summer; they cover the route at more frequent intervals and usually land the passengers nearer their homes or places of business. And in most cases the fare is much less. In the matter of speed the advantage is usually with the heavier trains on the steam railroads, with their comparatively infrequent stops. But for hauls of from 30 to 60 miles the greater frequency and convenience of the electric trains is more than an offset to the difference in time in favor of the steam lines. In the suburban districts about Boston, Philadelphia, Cleveland, Detroit, Minneapolis, St. Paul, Milwaukee, and to some extent in the neighborhoods of Chicago and St. Louis also, the electric railways have proved very popular and have cut into the receipts of the older steam lines to a noticeable extent. In many other places, too, there are parallel lines, where steam and electric roads compete, to the detriment of the former.

If the electric system offers the greater economy for local traffic, as it assuredly does under all ordinary conditions, the remedy for the steam-railroad corporation is evidently the adoption of the later method, either by new construction or by co-operation with existing electric-railway companies. There are not lacking indications that progressive companies, like the Pennsylvania and New York Central, are taking this view of the situation. It is reported that the former company will soon build parallel tracks for trolley lines along portions of its system. In a New York daily paper it is stated that officers of the New York Central company, commenting upon this prospect, predict that a similar arrangement is sure to come in the end on nearly all the important roads. The cost of operating the trolley-cars, it was pointed out, is much less than getting up heavy trains and running them frequently. Already at Niagara Falls and on one or two branches, the New York Central has substituted electric-motor cars for steam trains, and the experiment has been satisfactory. It is believed by many railroad officials that at some time in the future the railroad company will use its steam trains largely for long-haul passengers and freight, and make use of the electric system for short rides between intermediate stations and the moving of freight which is not to go far.

It may be, too, that with the adoption of high voltages for the transmission of alternating current and sub-stations for the distribution of direct current of lower pressure, it may be possible to operate long trunk lines with economy. Or an alternating-current motor may be brought forward to solve the problem. But at present the field of electricity in practical commercial railroad operation seems to be limited to hauls not exceeding 150 or 200 miles.

Death of Professor Bunsen.

On August 16th science sustained a great loss in the death of Robert Wilhelm Eberhard Bunsen, M. D., professor of chemistry at the University of Heidelberg. Professor Bunsen was in his 89th year and one of the "grand old men" of the scientific investigation of the century. He was born in Göttingen and graduated at the university in his native town. He was interested in all the natural sciences, but devoted himself especially to chemistry. In 1838 he was appointed to the chair of chemistry in the University of Marburg, where he remained 13 years. Then, after a year at Breslau, he removed to Heidelberg, where he was professor of chemistry until his death.

The value of the original scientific research conducted by Professor Bunsen is so great that he may be considered the peer at least of any chemist of his time. His discoveries and inventions are many, but he is perhaps best known in the scientific world for having laid the foundation of the science of spectrum analysis and the discovery by its means of the two alkali metals, cæsium and rubidium. These discoveries were made in connection with his no less celebrated colleague, the late Professor Kirchhoff.

In 1841 Bunsen invented the form of voltaic cell bearing his name—a couple consisting of elements of zinc and carbon immersed respectively in electrolytes of dilute sulphuric and strong nitric acids. This battery was of great value, not only in laboratory work, but in many practical applications. One of the favorite and fruitful themes of Dr. Bunsen was the preparation by electrolysis of the rarer metals. He produced metallic magnesium, chromium, aluminum, the alkaline earth metals and the metals of the cerium group. These experiments had a practical result, and were followed by the commercial manufacture of magnesium, cerium, lanthanium and didymium. His battery was used not only in the service of inorganic chemistry, but with its help clear light was thrown upon the constitution of organic bodies.

The University of Leyden conferred upon Professor Bunsen the honorary degree of M. D. in 1875. In 1877 the University of Heidelberg commemorated the 25th anniversary of his election to the chair of experimental chemistry. In 1883 he was appointed one of the eight foreign associates of the French Academy of Sciences. Last year the British Society of Arts made him the recipient of its annual Albert medal. His contributions to science were thus summed up by the council of the society in voting him the honor:

"Among the numerous and important scientific discoveries which have rendered the name of Bunsen famous wherever science is valued, perhaps the most striking is the one in which he was associated with his distinguished colleague, Professor Kirchhoff, viz., spectrum analysis, a discovery which has shed a new and unexpected light on the composition of terrestrial matter and has enabled us to obtain a distinct knowledge of the chemical composition of sun and stars. The contributions which Bunsen has made in the application of chemistry and physics to the arts and manufactures are of the utmost value, and their importance may be measured by two out of many instances. The Bunsen battery was, until the introduction of the dynamo, the cheapest source of electricity; the Bunsen gas burner, by which a non-luminous, smokeless, but highly heated flame is obtained, is now not only indispensable in all laboratory work, but is used for heating purposes in thousands of houses and manufactories, and for illumination, by the incandescent system, in millions of lamps. Beyond these Bunsen's contributions to the sciences of chemistry and physics have been of the highest importance; but perhaps the greatest benefit which he has conferred through a long life devoted to the advancement of science has been the influence which he has exerted as a teacher."

American Street Railway Association.

The local committee of the American Street Railway association, which has in charge the general arrangements for the annual meeting and exhibition of the association in Chicago, from October 17th to 20th, held a meeting last week, at which J. M. Roach, the general manager of the Chicago Union Traction company, was elected chairman. Nearly all the space in Tattersall's building is now taken by exhibitors and everything points to a well-attended and successful meeting. The local committee is composed of the following-named gentlemen: J. M. Roach, George A. Yuille, H. M. Sloan, H. H. Windsor, F. L. Fuller, James R. Chapman and T. C. Penington.

Electrically Heated Theater.

The first theater in the world to be heated by electricity is the Odeon in Buenos Ayres. A short time ago the proprietors asked a local company if it would undertake to heat their premises by electricity, writes a correspondent of the Chicago Record, and, although the management had many misgivings as to the possibility of being able to do so, so sanguine was the electrical engineer of the concern, an American, that he could devise a practical and satisfactory system of electric-heating apparatus for the purpose, that he was given carte blanche and immediately proceeded to work out his scheme, which he has done successfully.

Society for the Promotion of Engineering Education.

The seventh annual meeting of the Society for the Promotion of Engineering Education was held in Columbus, O., on Thursday, Friday and Saturday, August 17th to 19th.

In addition to the usual routine business, the following-named papers and addresses were presented:

Address by the president, Thomas C. Mendenhall; "The Essentials of a Technical Education," A. L. Rice; "The Engineering Educational Value of a Refrigerating Plant," William T. Magruder; "The Place of Correspondence Schools in Engineering Education," Edgar Marburg; "Advanced Algebra in Engineering and Other College Courses," F. L. Emory; "Hydrocarbon Engine-testing Plant of the Ohio State University," William T. Magruder; "Teaching Force Assigned per Student in the Several Divisions of a Technical College," J. P. Jackson; "Methods of Teaching: by Textbook, by Lectures, by Laboratory, by Design, by Memoir," C. F. Allen; "A Catalogue and Clipping Case," William T. Magruder; "Engineering Education and 'Expansion,'" W. S. Aldrich; "A Convenient Laboratory Equipment for the Study of Direct-current Dynamos and Motors," H. B. Smith; "A Comparative Study of the Electrical Engineering Courses Given in Different Institutions," F. C. Caldwell; "An Apprentice System in College Shops," O. P. Hood; "Drawing, Mechanical Laboratory Practice and Shopwork in Engineering Colleges," H. E. Smith; "The Desirability of Uniformity in the Use of Mathematical Symbols and Terms," A. E. Haynes; "The Use of Graphical Methods in the Solution of Problems in Mechanics," C. M. Woodward; "On the Nature of Entropy," Albert Kingsbury; "The Elective System in Engineering Courses," C. R. Jones; "Direct-current Work in the Electrical Engineering Department of the University of Minnesota," F. W. Spring.

The discussions of the papers were lively and interesting and the programme was one of great benefit to the membership.

The following-named officers were elected for the year 1899-1900:

President—I. O. Baker, University of Illinois.

Vice-presidents—R. Fletcher, Dartmouth College; C. D. Marx, Leland Stanford, Junior, University.

Treasurer—C. A. Waldo, Purdue University.

Secretary—Edgar Marburg, University of Pennsylvania.

The following-named members of the council were elected for the term 1899-1902: Brown Ayres, G. W. Bissell, J. J. Flather, W. T. Magruder, F. W. McNair, J. M. Porter, A. J. Wood.

Members who were in attendance were the following-named: A. Kingsbury, W. T. Magruder, T. C. Mendenhall, H. T. Eddy, Mansfield Merriman, F. C. Caldwell, A. J. Wood, H. E. Smith, F. W. McNair, C. A. Waldo, W. K. Hatt, W. D. Pence, C. L. Mees, G. W. Bissell, A. L. Williston, M. C. Ricker, O. P. Hood, J. M. Porter, A. N. Talbot, J. N. Bradford, H. I. Jacoby, F. E. Sanborn, C. F. Allen, W. K. Palmer, B. F. Groat, S. W. Robinson, C. R. Jones, E. Marburg, W. S. Aldrich, L. E. Reber, Storm Bull, F. E. French, E. A. Bending, F. W. Brady, R. S. Woodward, G. B. Halstead.

The members of the society were treated by the Columbus Engineers' Club to a trolley ride to Minerva Park on Friday evening. At the park a dinner was served in the pavilion of the Casino, and many of the party attended the Casino Theater as guests of the club. The many laboratories of the Ohio State University were visited by those interested.

The success of the local details of the convention was complete and due to Prof. W. T. Magruder of the Department of Mechanical Engineering, Ohio State University.

International Electrical Congress at Paris.

The Universal Exposition of 1900 is sure to gather together in Paris a large number of the leading scientific men and engineers of the world. This justifies the French electricians in their efforts to organize an International Electrical Congress, which has received the official patronage of the French government. In previous conferences questions of units and nomenclature have been settled by international agreement, to the great advantage of all concerned. During the last 20 years there have been unexpected discoveries, new applications of what seemed once to belong to pure science, and an extraordinary expansion of electric industries. Practice has thus started up a great number of problems, on which it will be interesting and profitable to have the views of technical authorities. The discussions of the congress will therefore have especially an industrial and economical character. The work is, provisionally, divided as follows:

1. Scientific methods and instruments of measurements.

2. Production of electric energy; transformers; transfer and distribution; electric lighting; traction.

3. Electro-chemistry; electro-metallurgy, accumulators; electric furnaces.

4. Telegraphy; telephones and various applications.

5. Electro-physiology.

The congress will last during the week ending August 25, 1900. The subscription for membership is 20 francs.

The Johnsons in England.

The Johnson brothers, Tom and Albert, well known as street-railway operators in Brooklyn, Cleveland, Detroit and other cities, are endeavoring to introduce electric street railways in London. As a preliminary they are surveying a route from London to Brighton, a distance of 45 miles, which they expect to cover, over a private right-of-way, in about an hour, for a fare as low as sixpence. They expect to build a first-class railroad, if given the privilege, with well-built roadbed, very heavy rails, large, handsome cars and powerful motors. The present fare on the steam roads is said to be six shillings, and it is the intention to furnish better and swifter transfortation at one-twelfth of the existing rate. It is expected that the new road will become very popular and that it will be such an object lesson to Londoners that the building of electric railways in the great extent of London itself will not be delayed.

Mr. Albert L. Johnson is enthusiastic over the future of electric roads in London. In speaking of it he said: "In London all the street railroads are owned by the city. They are, however, leased to corporations which run them as far behind the times as London is old. There is a population of nearly 6,000,000, yet there is no trolley and only one cable road. If you want to get across the city you must change from one bus to the other until the fare becomes enormous in comparison with what we pay in America. Those who have studied the city say that its marvelous population can be ascribed to one thing, and that is the ease with which one may go to any other city on the face of the globe. Within 20 minutes' walk from St. Paul's are the lines one may use to go anywhere. Yet, with facilities for reaching other places, London is the most inconvenient city in the world to get around in. It is just this latter trouble which we intend to remedy. No one has ever asked for a similar franchise, and we expect to win because of its very novelty."

Chicago's Fall Festival.

Chicagoans are making extensive preparations for the fall festivities that are to be held in this city between October 4th and 10th. The sum of $18,000 has been set aside by the arrangement committee, to be used for decorations. State street, between Lake and Congress streets, will receive the greater portion of the appropriation, and the plan adopted will combine features of the designs used at the coronation of the czar of Russia, the carnival of Rome and the decorations prominently displayed in memorable events in Paris. Along each side of the thoroughfare will be erected Venetian masts and carved columns of staff. The masts will be located at the edge of the sidewalk on either side of the street, 82 feet apart. Both the masts and the columns will be 38 feet high and connected by elaborately decorated arches. From each of the columns there will be strung heavy folds of bunting. Festoons of incandescent electric lights will be hung across the street, as was done last year, and also lengthwise of the street, connecting the flagstaffs and columns. Great stress will be laid upon the artistic features of the electrical illumination, and it is hoped that a distinct advance will be made in this respect. The lamps will be placed 18 inches apart, and it is expected that, with flambeaus of gas on every mast and column, they will present a fine effect. The merchants along State street are also planning to aid the decoration committee by the display of electrical designs. An interesting feature of the festival week will be an automobile parade, which is now announced as a certainty. Definite arrangements have not yet been made, but it is announced that about 50 electric vehicles will be in line, the Woods Motor Vehicle company alone furnishing 25 or 30 machines. The American Electric Vehicle company and others will be represented.

A Canadian View.

This is a paragraph of an article on the industrial situation that recently appeared in the Toronto World: Great Britain is now face to face with a rival that is fired with the enthusiasm and ambition of youth. Great Britain is set in her ways, and her ways are ancient. The United States is always on the alert to cast aside the old and adopt the new. Her conservatism and adherence to custom are what is hampering Great Britain more than anything else. She is too slow to adopt new methods. It is almost impossible for us to believe that Scotland Yard, the great police headquarters of London, is without a telephone, yet such is the fact. The United States made as much headway in introducing the telephone in five years as Great Britain has made in 20. Great Britain is simply not in it with the United States in the manufacture of electric machinery, and it is only during the last year or two that the people of Great Britain have recognized the advantage of electric street cars. Great Britain is as badly in need of a shaking up, commercially, as some of the decadent nations are politically. Only a few years ago—less than five—Great Britain was recognized as the greatest producer of iron and steel in the world. The United States now enjoys that proud distinction. The Americans are taking away the trade of the British in the latter's own territory.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Use of Telephones in Railroad Operation.

The fact that the New York, New Haven and Hartford Railroad company has put in telephones in all its signal towers, anticipating, possibly, a strike of the telegraph operators, calls attention again to some of the advantages of the telephone in train operation. Train dispatching by telephone is done on some of the cross-country electric roads near Cleveland, and by at least one elevated-railroad company in Chicago, but the eastern system just mentioned is probably the most extensive where an effort is making to rely on the telephone, rather than the telegraph, in dispatching trains.

This subject is considered by George W. Blodgett of Boston in a recent issue of the Railroad Gazette, and as the writer points out some of the superiorities of the telephone and gives practical hints for its use in the transmission of train orders, it will be of interest to the telephone men who read the Western Electrician.

The telephone has been found valuable even in the limited way in which it has been used for railroad purposes. It is the belief of the writer that it can be made of greater service with a corresponding gain in its value and efficiency, and a great saving of time. He does not know of an actual installation of telephones where there has been a systematic, comprehensive plan worked out beforehand for the general use of this instrument with proper safeguards and precautions against errors and neglects. In sending messages by telephone, there is no record of the actual message sent over the line, or of what it was understood to mean at the receiving end. In the case of telegraphic messages there may be an automatic record of the message actually sent for comparison and verification with the original at any subsequent time thereafter, but in the case of the telephone, the message as it is understood may be very different from what was intended, and there is usually no way of fixing the blame for the error beyond a reasonable doubt.

It is probably this fact more than anything else which has made railroad managers so conservative about the use of the telephone for any except unimportant matters. A proposition to use the telephone for the transmission of train orders which are now sent by telegraph would not be seriously considered. Yet it can be so used with as great a degree of safety as is now experienced in the transmission by telegraph, and with a great saving of time.

It is not in the transaction of ordinary business about which there is no urgent haste and no particular risk that the telegraph is most important; it is in cases where life and death are at stake; where minutes or even seconds are of priceless value; where the delay of an instant may determine the fate of a hundred people or many thousands of dollars' worth of property. Under precisely the same circumstances the telephone would be as much superior to the telegraph as the latter is to a letter sent by messenger. With the telegraph time is consumed in getting communication with the person to whom it is desired to send a message; time is required to transmit the words or characters of the message; more time is taken up in preparing it for the person to whom it is to be delivered; still another loss is occasioned by the delay or failure of this latter person to understand what the message required, or to act upon it when it is understood. There is a chance for error in each of these transmitting or receiving parties, and in the copying or delivery of the message, when it is not received directly by the person to whom it is addressed.

In the transmission of messages by telephone some of the same errors may occur, or others peculiar to the use of this instrument, but in spite of all the objections that are brought against it, the telephone is coming more and more into use for railroad purposes and with increased favor. Such improvements have been made in the instruments, in the methods of using them and in the better education of operators, railroad officials and the public generally as to the proper ways of using the telephone, that for many purposes it is now as reliable in every way as any of the means previously in general use. With the use of safeguards which are now well-known, and of others which may be devised to meet the needs of each particular situation, transmission by telephone can be as safely done as it is to-day by the telegraph. The writer has made some study of this matter, and will give here his conclusions, in the hope that they may be freely discussed, the errors pointed out if they exist, and a better way discovered.

The proper procedure for sending important railroad messages by telephone would, he thinks, be in accordance with the following requirements:

All messages should be first written or copied out in full in a book kept solely for that purpose (as is now done in most cases with train dispatcher's orders sent by telegraph), and this should be done, whether the message is to be sent by the official himself or by an operator. While he is not quite certain what will be found the best practice, yet the writer believes that all train orders should be telephoned, whenever it can be done, by an operator specially trained for that business, but a typewriter or clerk may also profitably be employed to write out from dictation all such messages. As a typewriter cannot well be used for records in a book, the messages may be written on sheets of proper size and pasted or otherwise fastened into the book; or they may be written in a manifold book, and a copy given to the operator for transmission. When practicable, such messages should be received by the operator at the station to which they are addressed and written in a book used only for messages received. If the person for whom the message is intended is not present in person, the operator should write as many manifold copies as may be needed at the same time as the original is written. The person or persons who are to receive the order, before attempting to carry it out, should be brought to the telephone and report to the train dispatcher the message as they have received it. If this cannot be done at once, then the receiving operator should read the copy he has made verbatim to the sending operator, who should make the proper record, and the repetition by the persons who are to act upon the order should be made when they have arrived. The writer thinks this repetition should be made to the train dispatcher in person, and not to the operator, because if done in this way it will serve as a check upon the correctness of both the transmission and the receipt by the operators, and there will be a much reduced liability to error. The writer is clear in his own mind that in some way the official who issues the order and the person who receives it and is to act upon it should be brought into communication with each other before the final word is given.

The following steps would then be necessary in the regular transmission of train orders or other important messages:

(1) The message should be written by the train dispatcher, or at his dictation, in a book kept for that purpose.

(2) It is to be transmitted by the regular operator and recorded in a book by the operator who receives it, making at the same time as many manifold copies as may be necessary for the different persons who are to act upon the order.

(3) The reading by the receiving operator to the sending operator of the copy he has written down. If this is found correct, then

(4) The repetition by the conductor and engineer of each train which the order concerns directly to the train dispatcher of the message they have received, or of their understanding of what they are called upon to do.

The telephone over which this is done should be in a closed room or cabinet to which but one man is admitted at a time, in order that there may be no mere repetition by one man of what he has heard another say just a moment before.

(5) A record of the correct transmission and understanding of the order by all the men whom it concerns.

(6) The certification by the train dispatcher of the correct understanding of the message and the O. K. sign for the carrying out of the order.

The operator for sending train orders by telephone should be clear-headed, intelligent, thoroughly familiar with the working of the telephone in all circumstances, well versed in the use of expedients for supplementing or counteracting defective working at times when normal conditions do not exist. The transmission of important messages should by no means be intrusted to persons who have not been specially trained as telephone operators, except in emergency or for a temporary makeshift.

With precautions like the above, or such others as are adapted to the needs of each particular case, the writer believes that train dispatching can be as safely done with the telephone as with the telegraph, and with much less time and trouble, and it is his expectation that it will gradually come into use more and more for this purpose.

Suit for Injuries Received at a Pay-station Booth.

Joseph Keller has brought suit against the New York Telephone company to recover damages in the sum of $26,500 for injuries said to have been sustained by him in using one of the public telephone booths, known as "pay stations," maintained by the company. The pay station where the plaintiff alleges his injuries were received is at 100 Broadway, and the plaintiff charges that the booth was in a dangerous condition. In the complaint it is alleged that this booth was in an inner room on the first floor of the building, and to reach it customers had to enter a door from the main hall, pass over the platform of a staircase, and turn to the left, "and a person entering said premises and turning to the right instead of to the left would be precipitated down the said stairs, a distance of about 25 feet."

It is further charged that the end of the platform was within the line of the door, and a person entering the doorway would be liable to step on the end of the platform and be precipitated down the stairs. According to the complaint, this is what befell Mr. Keller on the 13th of April last, and he alleges that he received injuries which confined him to his bed for nine weeks, and some of which are permanent.

Anti-Bell People Getting Together in New York.

A meeting of the stockholders of the People's Telephone corporation of New York city was held last week for the purpose of considering a proposition looking to the acquisition by that company of control of the New York and Eastern Telephone and Telegraph company and the Citizens' Telephone company. All three of the companies named were organized in opposition to the Bell monopoly. An officer of the People's company stated after the meeting that a practically unanimous vote had been taken in favor of the proposition. The plan, as outlined in the call for the meeting, provided for the issuance of $1,640,000 of stock for the purchase of the two companies mentioned. Of this, it is said that stock to the par value of $1,500,000 is to go to the Citizens' Telephone company and 1,400 shares, of a par value of $140,000, to the New York and Eastern company.

It is understood that the issuance of this stock is made conditional upon the New York and Eastern company obtaining the right to lay conduits and string wires in New York city. The New York and Eastern Telephone and Telegraph company is capitalized at $5,000,000. The company has, after long litigation, secured the right to lay conduits and string wires in Brooklyn.

The capital of the People's Telephone corporation is also $5,000,000. The company was organized by prominent members of the New York Board of Trade and Transportation, with others, to be operated in opposition to the present companies. The officers of the company assert that they are entirely serious in their undertaking, and that they have provisional contracts with a large number of prospective subscribers.

The Citizens' Telephone company is believed to be concerned with the manufacture of apparatus rather than the operation of a telephone system.

A Kansas City Scheme.

The Missouri and Kansas Telephone company is preparing a new system of rates for house telephones, to become effective soon. It will make a minimum rate of $18 a year for house telephones on circuit lines based on a minimum of 30 calls a month. The plan, according to the Star of Kansas City, is to charge five cents for each call made, but it only counts one way. For example, if a man has a telephone in his dwelling on this system it will cost nothing for him to call up the house from a downtown office, but if he calls up the office downtown from home he must pay five cents for the service. In effect, this means that the subscriber pays for only half the calls on his telephone. There is one limitation. The subscriber must agree to pay for 30 calls a month or $1.50, whether he uses the telephone that number of times or not.

F. F. Rozzelle, attorney for the company, explained, in discussing the change, that the company would have made the new rate several months ago, but its mechanical department had to invent a register, and that took time. The company's shop has some ingenious machinists, and it is one of the few places in the West where inventions are made to order. The register has been invented and the shop is beginning to build the machine. The subscriber in the future will press a button; this button will turn a series of dials with figures like those on a gas meter. This is in a glass case, where it cannot be tampered with, but can be seen by the subscriber every time he looks at the telephone.

Competition in Norwich, England.

Telephone competition is found to have its advantages in England, where the National company occupies a position somewhat analogous to that of the Bell company here. Says the Electrical Engineer of London: "We are informed by the Mutual Telephone company that the agitation carried on for the past seven years in Norwich has caused the National company to reduce its rates in that city to £5 for 800 calls. The significant part of the matter is, however, that the rate is only for one year, leaving it open for the National company at the end of that time to again advance the tariff, as was done in Dundee, Sheffield, Manchester, etc., where the rental of £12 was extorted after the competition was stifled. Our informant adds that Norwich people will not be led away by such tactics, and that an influential company has been formed for the purpose of working an exchange. We are not told, however, what steps the corporation of Norwich is taking, or that the proposed new company has the sanction of the corporation."

Central Union Mortgage.

The Central Union Telephone company filed yesterday, said the Chicago Times-Herald of August 10th, a supplementary mortgage securing an additional issue of bonds amounting to $500,000 to the Old Colony Trust company of Massachusetts under the same terms as entered in the mortgage for $6,000,000, dated January 2, 1899, known as five per cent. gold bonds. The property scheduled is in Illinois, Indiana and Ohio.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Greene and Weston Telephone company of Greene, Ia., has arranged to connect its toll line through Southern Minnesota with the new exchange of the Citizens' Telephone company, at Mankato, Minn. The latter expects to have toll-line connection with the Twin Cities soon after October 1st.

The Fergus Telephone company of Fergus Falls, Minn., has completed its toll line to Wadena, Minn., giving connection with 10 villages en route.

A company is being formed at Hillsboro, N. D., to build a telephone line to Mayville.

The Mississippi Valley Telephone company will soon have its exchange in Minneapolis ready for operation. The switchboard is being set up and will accommodate 3,600 connections when in.

The Little Wolf River Telephone company has been granted a franchise for an exchange at Stevens Point, Wis.

Clinton, Wis., will soon have toll-line connection with Beloit, Wis., Janesville, and other cities.

The Southern Electric Telephone company is running lines between Redwood Falls, Minn., and Sleepy Eye.

The Wisconsin Telephone company will make improvements and additions to its system in the vicinity of La Crosse, Wis., which will cost $20,000.

The Northwestern Telephone Exchange company, in Minneapolis, has sent a letter to all its subscribers, calling their attention to the fact that the rules of the company prohibit the use of its instruments by other than subscribers and employes. It also contains a reference to arbitrary measures which may be necessary in case the request is not lived up to. A number of Minneapolis subscribers take exception to it. The druggists think it is done for their benefit especially, and some have posted the letter up, with comments attached.

The effect of the sale of the Wisconsin Valley Telephone interests at Chippewa Falls and Eau Claire, Wis., to the Wisconsin Telephone company is beginning to become manifest. The Wisconsin company has announced that subscribers on the outside circuit will hereafter pay $2.67 per month. They have been paying $1.50. A number of subscribers have ordered their telephones out, and there is talk of organizing a new home company.

R. F. C. Iltis of Wadena, Minn., is forming a stock company to put in a local exchange.

The Kossuth Telephone company of Germania, Ia., is heading toward Blue Earth, Minn., with its toll lines, and has already perfected arrangements to tap Elmore, Minn. This company will also connect with a number of towns in Northern Iowa.

The wires of the Duluth Telephone company and the Zenith Telephone company at Duluth, Minn., meet in alleys every once in a while, and each company promptly appeals to the Board of Public Works for a decision against the other.

The Chicago and Lake Superior Telephone company is an applicant at Marinette, Wis., and the sister city, Menominee, Mich., for franchises to operate local exchanges.

Several of the outside stockholders of the Ottumwa (Ia.) Long-distance Telephone company claim that the sale of the company to H. F. Farwell of Astoria, Ill., was done without their consent and they were defrauded out of all they put into the enterprise by the sale. They threaten litigation.

Thomas Way of the Western Electric Telephone company, at Britt, Ia., has been nominated for representative by the Republicans of Hancock County.

The Northwestern Telephone Exchange company will rebuild its system at Austin, Minn.

The Iowa Telephone company wants its franchise at Des Moines, Ia., renewed, and wants it very badly. The company has been running without a franchise for a couple of years because it could not accept a franchise giving the council power to set a maximum rate, and the council would not give anything else. As a more tempting inducement, the offer has been made to remove the headquarters of the company from Davenport, build a handsome office building and rebuild its entire system in the city, if only a favorable franchise is granted.

The Home Telephone company of Sioux City, Ia., will soon have through toll connection with the Mutual system of Des Moines.

The telephone exchange in Garfield, Wash., was recently burned out, but has secured new quarters and will repair the exchange at once.

The Western Electric Telephone company announces free-toll service between Burt, Bancroft, Algona, Wesley, Titonka, Sexton, Germania, German Valley, Buffalo Center and Ledyard, Ia., and Elmore, Minn., to remain so until July 1, 1900, and possibly longer. The public is invited to make liberal use of these lines. It is a competitive measure.

The Spokane and British Columbia Telephone company has been refused a franchise for a local exchange in Spokane, Wash. A question has arisen as to the finality of the act of the council, and the charter seems to indicate that it was not finally disposed of. The company is preparing for a bitter fight to secure the franchise and for a struggle with the Inland company. The Spokane and British Columbia company applied to the Inland company for a telephone connection and was refused. Then rental was then tendered and again refused, when the matter was taken into court and an order issued to show cause why the telephone should not be installed.

Will Walker, manager of the Cedar Valley Telephone company at Dysart, Ia., has been transferred to Cedar Falls.

M. A. Childs, formerly with the Iowa Telephone company, has accepted a position with the Boone company.

J. W. Sanford of Chamberlain, S. D., has secured the franchise for a telephone system in that town.

It is reported that over one-half the stock required for the construction of a telephone line between Hillsboro, N. D., and Mayville, Minn., has been subscribed, and there is little doubt that the line will be constructed.

It is reported that the telephone system at Monroe, Wis., will be ready for operation on September 15th.

Telephone managers at Kenosha and McLeod, Wis., find that applications are so numerous for new telephones that they can with difficulty secure supplies to fill the demand.

Telephone laborers on the Zenith City Telephone line at Duluth, Minn., struck recently for a raise of 25 cents in their daily wages. The matter was compromised with but little trouble.

The Northwestern Telephone company has secured an extension of its franchise at St. Cloud, Minn.

The Blue Earth Valley Telephone company has secured a franchise for putting in and operating a system at Amboy, Minn.

The Home Telephone company of Montgomery, Minn., has purchased the New Prague Telephone company's line.

Notes from Central Illinois.

[From a correspondent of the Western Electrician.]

The Kinlock Telephone company of St. Louis has started to build connecting lines in Illinois, and will soon have East St. Louis, Madison and Venice connected with St. Louis. The objective point of the company this year is Springfield, to which place it hopes to extend its long-distance toll lines by January 1, 1900. The company will connect with all independent lines en route.

The Macoupin Telephone company is still taking stock, and will be incorporated in October. Fifteen cities and villages now have representatives in the new company, and the outlook is good for one of the best county organizations of independent telephone men in the state. All toll lines will be metallic.

The stockholders of the Palmyra Telephone company held a meeting recently and increased their capital 30 per cent. The new shares of stock were sold on the same day, and contracts were let for an increase of plant.

The Bunker Hill Telephone company is preparing to increase its stock to build toll lines from Bunker Hill to Brighton, Shipman and Staunton, thence south to other towns.

W. H. Dews has opened the first independent line at Chesterfield, and will continue to add thereto.

The Girard-Carlinville line is now under construction and will soon be ready for use.

W. H. Ramsey of Auburn has begun work on the Pawnee-Divernon toll line.

EXTENSIONS AND IMPROVEMENTS.

Work is soon to begin on the telephone line from Randolph, Utah, to nearby points.

Dr. R. E. Carlton contemplates constructing a telephone system from Bethany to Georgetown, Ky.

The Blakely (Ga.) Telephone company has completed its lines to Jakin, Saffold and Cedar Springs and has begun work on its line to Arlington.

The work of extending the lines of the Cecil (Md.) Telephone and Telegraph company, which were recently purchased by a syndicate, is now being rapidly pushed, and by October every point in Cecil County of any importance is expected to be connected. New poles and lines are now being put up between Elkton and Chesapeake City and Elkton and North East.

The Central New York Telephone company has begun the construction of a new metallic circuit from Onconta to Norwich by way of Oxford and Sidney. Heretofore it has been necessary for Oneonta and Cooperstown to communicate with Norwich by way of Utica. The new system will make better connections with New Berlin and all towns adjacent to Norwich.

The Hudson Telephone company of Jersey City has made arrangements to extend its conduits from Jersey City west across the Hackensack meadows to Newark. After a hard fight, the company has succeeded in getting permission from the Jersey City authorities to extend its lines in Jersey City as a rival to the New York and New Jersey Telephone company. The Hudson Telephone company has decided to increase its capital stock from $100,000 to $1,000,000.

NEW COMPANIES.

The Longview Telephone company of Longview, Texas, has been chartered, with a capital stock of $10,000.

The Chesterfield and Powhatan (Va.) Telephone company has been incorporated, with a capital stock of $5,000, by W. W. Baker, B. T. Watkins of Hallsboro, Dr. J. B. Fisher, W. P. Field of Midlothian, M. A. Cogbill and P. V. Cogbill of Chesterfield.

Amended articles of incorporation of the American Duplex Telephone company have been filed. The incorporators of the company are Joseph T. Lyons, Edward L. Tierney and John Carver Alden, all of Boston, Mass. The company will manufacture, sell and lease telephones, and its principal place of business will be Phœnix, Ariz. The capital stock is $1,000,000.

A telephone company has been organized at Jewell City, Kan., to put in independent telephone systems at Jewell City, Mankato and Burr Oak, and to connect the three places with toll lines. The company is headed by Mr. J. W. Berry of the Jewell Lumber company as president, and Mr. A. Whitney as manager and superintendent. The company expects to have the line in operation by October 1st.

The Granville (N. Y.) Telephone company has been incorporated, with a capital stock of $10,000. It will connect Granville, Middle Granville, Poultney, Vt., North Granville, Whitehall, Hebron, North and West Hebron, Salem, Hartford, South and East Hartford, Wells, Pawlet and West Pawlet, and all towns in Washington, Warren and Essex counties in New York, and Rutland and Bennington counties in Vermont. Its directors are F. T. Pember, Henry Dillingham, W. H. Hughes, E. W. Wyman, W. A. Tenney, F. W. Hewitt of Granville, F. W. Allen and A. T. Hughes of Middle Granville, and F. E. Hicks of Slyborough.

MANUFACTURERS AND DEALERS.

C. F. Splitdorf of New York has placed on the market several new telephone coils and is having an especially active demand for coils wound entirely with silk-covered wire. Mr. Splitdorf has won for himself an enviable reputation as a manufacturer of electrical coils, and his goods meet with ready sale from the fact that he knows the value of careful workmanship.

The George M. Mayer Electrical and Model Works of Chicago, which has for the last five years manufactured telephone switchboards and various supplies, and made a good reputation for itself in that line of work, as well as in the experimental field, has now been succeeded by the Columbia Electric and Manufacturing company of 79 Fifth avenue. This company has considerably increased the existing facilities, and will be prepared to turn out work promptly in first-class shape. It will direct its efforts chiefly to the manufacturing of telephone switchboards and parts thereof, as well as other electrical specialties, such as switch boxes and electrical instruments. It will also do experimental work to order.

TELEPHONE TALES.

In Nelson, New Zealand, says the Auckland Star, if you use the telephone you must not give the number; you must name the party you want, and the exchange girl will cheerfully tell you whether he is in or out; if the latter, where he is and when he will be back.

Mr. Queers of Kenton, O., relates the following experience with the telephone, through the local newspaper:

"B-rrr-rrr-rr-b! B-rrr-rrr-r-b!

I crawled out of bed, collided with a chair and introduced my left shin to the washstand.

"Hel-lo!"

"Is this the jail?"

"No, it isn't," and I banged the receiver up with so much energy that it awoke the baby in the next house and stopped a horse from snoring in the barn around the corner.

I swore that I would have the infernal machine taken out in the morning, but when morning came and with it the bright and beaming sunshine, I forgot the annoyance and even forgave the girl up at Central for her mistake when she called up and informed me that the lines were crossed, but they would be fixed, and my 'phone worked elegantly—for 24 hours.

The next night they got my place mixed up with the poorhouse. But that wasn't such a terrible error.

SUBSCRIBERS AND RATES.

The Nebraska Telephone company has reduced the monthly rental rate at Kearney on residence telephones from $2.50 to 75 cents and on business-house telephones from $3.50 to $2. The reduction is brought about by the competition of the Home Telephone company, recently organized there.

The report of the Southwestern Telegraph and Telephone company for the month of May, 1899, for the state of Texas, shows a total of 8,460 subscribers in seven cities. The number of subscribers gained in the same cities during May was 469, and the total increase in the state between January 1st and June 1st was 3,861.

The National Light Storage Battery company of Boston, capitalized at $1,000,000, has been incorporated under the laws of West Virginia.

Improved Duncan Wattmeter.

The Siemens & Halske Electric Company of America is now manufacturing the Duncan integrating wattmeter for single-phase alternating currents under the personal supervision of Mr. Thomas Duncan, and the facilities of its large works at Chicago have enabled him to perfect many improvements, which hitherto had only been contemplated.

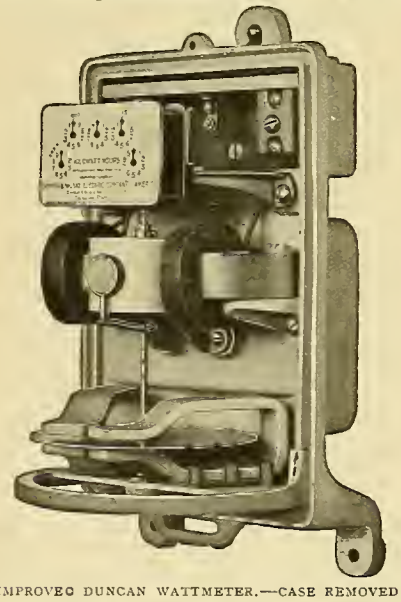
A meter which may be relied upon, by the station manager as well as by the consumer, for faithful and accurate registration is in demand. The Duncan integrating wattmeter has been newly designed

IMPROVED DUNCAN WATTMETER.

to fulfill every requirement of accuracy of record, permanent calibration and economy of operation.

The principle on which this meter operates is that of a simple rotating-field, alternating-current, single-phase motor, in which by an ingenious arrangement of inductance the current, divided into two components, a series and a shunt current, produces a rotating field. This is accomplished in such a manner that with the current and electromotive force of the work circuit in phase the torque is maximum, while with lagging currents on inductive loads the torque varies in proportion to the real watts, bringing the meter to a full stop when the displacement of current and electromotive force in the work circuit is 90 degrees. Thus the meter is fully qualified to measure accurately either inductive or non-inductive loads.

The rotating mechanism consists of a vertical



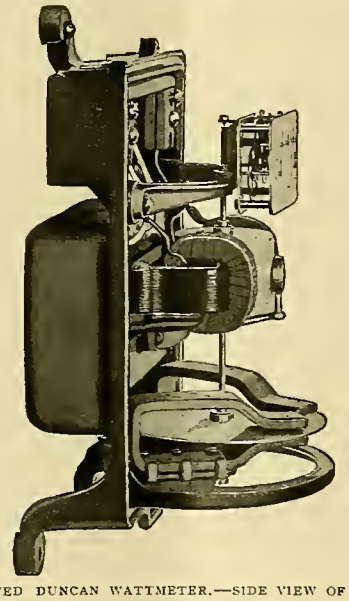
IMPROVED DUNCAN WATTMETER.—CASE REMOVED

spindle carrying the armature at about its center, a gear meshing into a dial mechanism at the upper end, and a retarding disk at the lower end. The stationary part consists of the case, the field coils and core, the shunt coil and core, the compensator and the dial mechanism. The fields are of laminated sheet-steel stampings riveted together, well japanned and fastened to the back framework of the meter. The poles project inward and carry the form-wound series coils, connected directly to the terminals of the meter. The armature core is also laminated, and is wound with a special shunt coil, the whole being placed inside the revolving armature. The shunt and series fields are at right angles to each other. All small wires are run through flexible rubber tubes; all connections are soldered; all terminal blocks are extra heavy. The armature is an inverted aluminum cup mounted on the spindle. It is simply a short-circuited winding of a single turn. In front of the armature is a disk of iron and copper; this is the compensator, mounted on a movable arm. By its use a much longer period of accuracy can be guaranteed to the meter than if the compensator were absent.

When the meter is shipped from the works, it is carefully adjusted to register in accordance with the voltage, capacity and frequency marked upon it, but in actual use it is not likely to meet with the ideal conditions of the testing room, while the same accuracy is required. The compensator is, therefore, used to obtain an accurate record, even under abnormal conditions. Where there is vibration, the ordinary meter will creep, while any roughening of the jewel, after long use, will cause the meter to run slow. Moving the compensator to the right will overcome the frictional effect of the roughened jewel, while a movement to the left will prevent creeping.

The retarding device is a disk of aluminum revolving horizontally between the poles of two permanent magnets of tungsten steel, exposed, after tempering, to a special process for aging to insure permanency. The magnets are fastened to the base by brass clamps. By means of this device a retardation is secured exactly proportionate to the amount of energy passing through the meter.

The registering train is unusually large, the teeth of each wheel being accurately cut. The wheels are not cramped, and the dials, large and distinct, may be easily read. Since nearly all stations sell current by the kilowatt-hour, these wattmeters for domestic service read directly in kilowatt-hours, while for foreign use they are made to read in Board-of-Trade units. When desired, they can be furnished



IMPROVED DUNCAN WATTMETER.—SIDE VIEW OF MECHANISM.

to read in watt-hours. All sizes, from five lights to 150 lights, are direct-reading, thereby eliminating the use of constants or multipliers. In meters of larger capacity a small series transformer is used.

To secure a bearing having a very long life, Ceylon sapphires, carefully ground, are alone used. The jewel is set in a removable spring socket, and the point of the spindle, also removable, is glass-hardened. When handling or shipping the meter, the spindle is raised off the jewel by a knurled nut beneath the disk.

The impedance coils are enclosed in an iron box securely fastened to the back of the meter. They are so surrounded by iron that they are effectually sheltered from outside magnetic influence.

The case is in two parts, back and cover, hinging together by a slot and tongue at the bottom and fastened by a screw at the top. The back is of heavy cast-iron. The cover is of sheet metal, fitting tightly into a rubber-lined groove in the back, which renders the meter dust, insect and moisture-proof. The case is heavily japanned, both inside and out. The leading-in wires enter the meter at the top through rubber gaskets. All meter parts are interchangeable.

These integrating wattmeters are manufactured for secondary and primary circuits in the following sizes: 50 to 55 volts, five to 600 amperes; 100 to 110 volts, three to 500 amperes; 200 to 250 volts, two-wire, lamp and motor service, three to 250 amperes; 200 to 250 volts, three-wire, 100 to 125 volts on each side, three to 250 amperes; 500 to 600 volts, motor service, three to 150 amperes; 1,000 to 2,000 primary circuits, five to 500 amperes. Their accuracy is guaranteed on all loads, whether inductive or non-inductive.

The citizens of Batavia, Ohio, have voted to issue $18,000 in bonds for an electric-light plant.

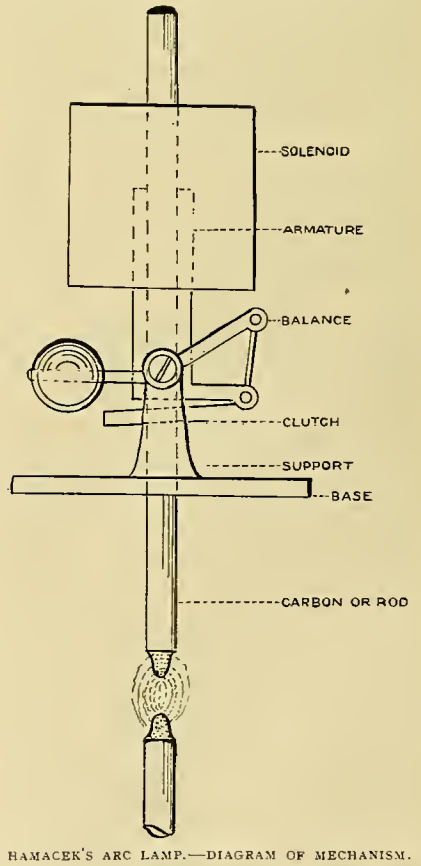
Hamacek's Alternating-current Enclosed Arc Lamp.

This lamp is in many respects a radical departure from former practice in this field, and it is said to embody the most advanced ideas, both mechanically and electrically. It is put forth as strictly up-to-date, with all the requirements essential for an economical and reliable lamp.

In the regulating mechanism an armature of laminated iron is used, so combined with the solenoid that great range of adjustment is secured, and it

HAMACEK'S ARC LAMP

is asserted that the lamp will maintain an arc on as small a current as it is possible to use to produce an arc light between carbons. Induction and vibration, heretofore troublesome in alternating-current arc-lamp mechanisms, are obviated by the use of very few turns of coarse wire in the solenoid, instead of many turns of fine wire. No. 12 or



HAMACEK'S ARC LAMP.—DIAGRAM OF MECHANISM.

No. 10 B. & S. wire will answer for lamps running on from 1½ to five amperes. The same mechanism can be adjusted for the consumption of current from 1½ to 6½ amperes in less than one minute. It is adaptable for either rod or direct-carbon-feed lamps.

A simple mechanical and electrical balancing movement is used. This reduces the electrical energy necessary to strike the arc and maintain the

regulation to a minimum, with resulting efficiency of light. With the objectionable feature of vibration entirely absent, the way remains clear for producing a noiseless mechanism. The humming sound due to the passage of the current through the space of the arc is deadened by the use of enclosing globes, and as a result the lamp is practically a noiseless one. The new lamp is claimed to be simple, easy to make, cheap and reliable; to have longer range in feed of carbons, due to variation of voltage, than heretofore known; to be short, long-burning, taking 100 watts or 500 watts, direct or alternating current, and, if the latter, for 72 or 125 cycles. Of course, it can be used with any form of globes, shades, reflectors and ornamentations.

National Water-tube Boiler.

The National Water Tube Boiler company, started 52 years ago under the name of National Iron Works, has changed hands recently. The new owners are all business men of New Brunswick, N. J., of high standing. The directors of the company are Hugh McKeag, Philip Weigel, Jr., Robert J. Smith, P. M. Welsh, P. G. Polhemus, C. A. Schenck and Hugh Boyd. The officers are: President, Hugh McKeag; vice-president, P. G. Polhemus; secretary and manager, C. A. Schenck; treasurer, Philip Weigel, Jr.

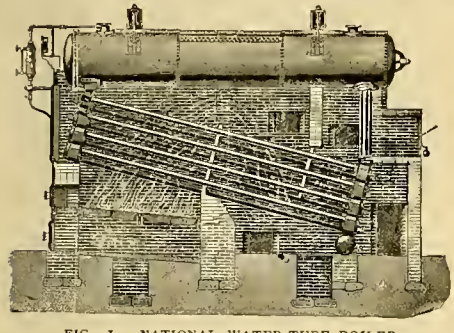


FIG. 1. NATIONAL WATER-TUBE BOILER.

Secretary and Manager Schenck has been with the National Water Tube Boiler company for 11 years. During the latter part of that time he has been acting as manager. Mr. Schenck is a man of much executive ability. He is thoroughly acquainted with the workings of the business as a result of his wide experience, and will no doubt do much to improve the condition of the concern.

The National water-tube boiler is said to combine all the advantages of well-tried principles of construction, besides the best materials and appurtenances obtainable. The parts can be easily removed and cheaply replaced. There is abundant disengaging surface for the liberation of particles of steam, constant and free circulation in every part, equal division of strains throughout and provision for all changes through unequal expansion. The boiler affords easy accessibility to every part inside and out, and excellent arrangement of furnace for complete combustion, the heating surfaces being in a position to receive impinging effect of gases. The joints and sheets of the boiler are removed from direct action of the fire, and the suspension is from supports distinct from the enclosing walls, and all parts are carefully finished. The boiler has a great excess of strength above possible steam pressure, correct proportion securing best results of material.

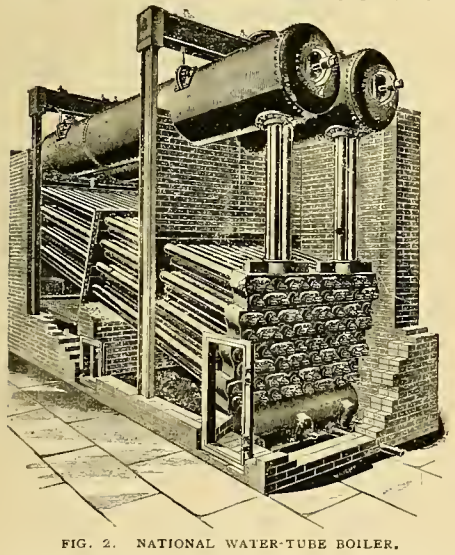


FIG. 2. NATIONAL WATER-TUBE BOILER.

The National header has distinctive features which give the National boilers preference over many others with those who have them in immediate charge. Assured safety from danger of injury from breakage, convenience for the removal of the plates covering the opening to the tubes, large space for taking out damaged tubes and entire exemption from leakage are advantages which the attendant cannot too highly value.

The peculiar form permits the strongest bracing, and the utmost care has been taken in the patterns to provide for contraction and expansion in heating and cooling. The walls of the headers are very heavy, and the material is a firm, tenacious mixture, especially adapted for use under extreme pressure.

In the accompanying cuts of the National boiler, Fig. 1 is a side elevation, showing position of cleaning doors, and Fig. 2 shows the method of suspension and connections at rear end.

Improved Cable Clip.

The improved Holdfast cable clip that is being put on the market by James S. Barron & Co., New York, is worthy the attention of telephone construction companies. It is claimed by the manufacturers that the clip is quickly and easily applied by hand and can be removed from time to time for new work, as may be desirable, without destroying its efficiency. To use it, the metal strap is simply drawn around the cable and passed through the hanger; the part with the hooks is then turned up, as shown in the illustration, which action takes up the slack, binds the strap tightly about the cable and prevents the latter from slipping. All parts are carefully made, and being of galvanized steel and zinc, they are not liable to injure the cable. This improved clip is now being used very extensively by some of the principal telephone companies, many hundred thousands of them being in service throughout the country. It is claimed to be the best as well as the cheapest cable hanger yet produced.

Automobiles for Postal Service.

A Washington dispatch says that it is very unlikely that the Postoffice Department will authorize the use of automobiles at any postoffice within the next two or three months at least. Applications have come to the department from postmasters in all parts of the country, desiring to introduce the automobile, and from firms desiring to furnish them and offering the use of different machines for experimental purposes. While the department has a fund out of which it pays for horse hire and allowances, which, it is believed, might be diverted to paying for automobiles, it would not go very far at the prices now asked for these machines.

No official tests have been made yet by the department, although letter-carriers have been allowed to make their rounds in a few instances by means of automobiles. The special agent in charge of the investigation into the advisability of using automobiles has been authorized to make an Indiana manufacturer an offer to use his vehicles in experimenting in an Indiana town where free delivery is soon to be established, and it is probable that the proposition will be accepted. If the machines prove satisfactory they may then be purchased by the department and continued in use. There is no prospect that any automobiles will be placed in the postal service, except in the Indiana town, as stated, for quite a while to come.

Why Not Train Grape Vines on Lightning Rods?

The subjoined dispatch from St. Joseph, Mich., to the Chicago Record, dated August 18th, gives a hint to lightning-rod salesmen that should not be overlooked:

The presence of full-grown ripe Worden grapes upon this market for the last three days has been puzzling the oldest grape-growers of this vicinity, who report that this particular variety heretofore have not been ripe enough to market before September 10th. The growers who are now marketing the ripe grapes account for the condition by the fact that the large vineyards of their district were struck during an electrical storm, and lightning leaped along entire rows over the wires which support the vines. Contrary to the growers' expectation, who thought all the vines would be ruined, the green fruit began to ripen immediately, and only a small portion of the vines were injured by the lightning.

Escaping Current Causes Trouble in New Jersey.

Wires of the Plainfield (N. J.) Gas and Electric Light company, carrying an alternating current of 1,000 volts, recently caused considerable trouble at a point where the insulation had been worn off by a tree. The current passed down the tree, which was wet from a rain, and by means of a wire guy, that supported an iron electric-light pole nearby, and which also rubbed against the tree, the current reached the wet ground and shocked several persons and some horses that were passing.

A similar incident is reported from Elizabeth, N. J., where a team of horses was instantly killed by walking into a large pool of water into which a live electric-light wire, that had been broken during a storm, had fallen. The driver was severely shocked and knocked off the seat of the wagon, the current having evidently passed to him from the horses along the wet reins.

CORRESPONDENCE.

New York Notes.

New York, August 21.—The new power house of the Third Avenue railroad will be 320 feet long and 250 feet wide. It will rest on a table of concrete seven feet thick, which will in turn rest on piles 40 feet in length. There will be 32 batteries of large boilers and 16 engines, each developing 4,000 horse power, and which can be worked up to 6,000 horse power. The complete system, when installed, will, therefore, be able to furnish 96,000 horse power. In order to avoid waste of power in transmission and the use of long shafts, the generators will be placed between the cylinders of the engines. The voltage of the current generated will be 1,100, which will be reduced at the branch stations to 500 volts.

Tests of the Clark system of space telegraphy, which were begun at the Lighthouse Department, Tompkinsville, recently, were continued Friday under the supervision of W. J. Clark. They were confined to the transmission of signals. A very sensitive transmitting apparatus of the army set of instruments was placed on the lighthouse tender Mistletoe, while the inexpensive set was used on shore. Signals were perfectly received at the distance of 3½ miles, but at a distance of five miles they were not so clear. Mr. Clark believes that with his inexpensive instruments it will yet be possible to receive messages at a distance of 15 miles.

At a meeting of the stockholders of the New York and North Shore trolley road last Tuesday it was decided to lease the Whitestone and College Point road for the term of 999 years. The stockholders authorized the issue of the necessary bonds for the construction of the new road and directed that work be begun as soon as the construction of the extension from Flushing to Jamaica is completed. This line will be operated in connection with the Flushing line of the New York and Queens County road.

To settle the numerous rumors that have been afloat regarding the dissatisfaction said to have been caused by President Clinton L. Rossiter of the Brooklyn Rapid Transit company, the board of directors of the company has unanimously passed resolutions expressing the board's cordial appreciation of the manner in which the affairs of the company were administered by the president during the recent strike, and thanking him for the skillful manner in which greater trouble was averted. The resolutions also state that the retirement of Mr. Rossiter from the presidency of the company has never been contemplated nor has he ever thought of resigning.

It is reported that the Babcock & Wilcox company may purchase property at Bayonne for a large new boiler-manufacturing plant. The factory at Elizabethport would then be transferred to the new site and buildings to cost more than $1,000,000 would be erected, which would give employment to over 1,000 men

The Orange and Passaic Valley Railroad company, which operates the trolley line between Orange Valley and Bloomfield, has bought a large plot of land near its present car barns, and within the next 60 days will erect a car barn 80 feet wide and 190 feet long. It will be built of brick and will have storage room for 80 cars. Learning a lesson from the burning of the cars in the Newark and South Orange car barn recently, the tracks will be laid with a decided slope toward the street, so that, in case of fire, it will be only necessary to release the brakes on the cars, when they will roll out without power.

A. O. Schoonmaker, the mica dealer, says that he is not in the trust. He reports that the mica business is particularly active and that every indication points to a good fall trade.

The Ward Electric Supply and Construction company, dealer in electrical supplies at No. 133 William [illegible] has assigned for the benefit of creditors to Isaac W. Ullman. The company was incorporated in 1896 with a capital of $15,000. M. S.

Canadian Intelligence.

Ottawa, August 19.—The Montreal Electric Street Railway company is about to place an electric pay car in its service, so that the men, instead of receiving their monthly wages at the company's office, will be paid at the various centers. The new pay car is constructed much on the same principle as the regulation mail car used in many parts of Canada in the electric street-railway service. The car is divided into two compartments. One is merely a passageway, through which the person receiving money will pass, entrance being made at one end of the car and exit by the other end. The other compartment is occupied by the paymaster and checker, and is properly secured and guarded from intrusion.

The town of Nelson, B. C., was en fete on July 31st, when the first spike of the electric street railway to be built there was driven by Mr. C. S. Drummond, managing director of the Duncan mines and a director of the British Electric Tramway com-

pany, which operates 40 such lines in various parts of the world, and which is constructing lines in British Columbia. The spike was a gold one, and it was afterward presented to Mr. Drummond by the mayor of Nelson. This road will be the first street railway in the Kootenay, and, in fact, the only one outside of the coast cities.

The Light, Heat and Power company of Lindsay, Ont., is contemplating the immediate development of 1,000 horse power at Fenelon Falls, which will be transmitted to Lindsay, a distance of 14 miles. The hydraulic engineer in charge is Mr. C. H. Mitchell of Niagara Falls, Canada.

Mr. Rice, hydraulic engineer of Dayton, O., is consulting engineer for the Grand Falls Water Power company of Grand Falls, New Brunswick. This company proposes to develop the power of the Tobique River in that province.

The Royal Electric company of Montreal, Que., has been awarded the contract for the Ragged Rapids power-transmission scheme, at Orillia, Ont., the original contractors having abandoned the work. The tender of the Royal Electric company is said to be $71,000. This is $3,800 more than the first contract price, but considerable additions have been made. The company undertakes to furnish lighting by the first of November and power by the first of December of the present year.

Mr. G. F. Macdonald of Ottawa is the only Canadian holding office in the National Association of Municipal Electricians, which will hold its annual convention in Wilmington, Del., commencing September 5th next. He is the vice-president of that body. Mr. Macdonald is busy preparing a paper which he will read before the association. The subject is "Progress and Development of Police and Fire-alarm Electric Systems in Canada." With a view to obtaining as full information as possible, Mr. Macdonald has written to and received replies from the various Canadian cities having such systems.

The 30-year franchise to the Toronto Electric Street Railway company was granted in 1891. The city, under the terms of the franchise, receives eight per cent. of the receipts up to $1,000,000, and 10 per cent. of the receipts over and above this amount. Besides this the company pays to the corporation a certain mileage allowance. The city's share of the receipts from the company now amounts to about $164,000 per annum.

The Rev. William Fraser, pastor of the Tradesdon Free Church, Glasgow, Scotland, who is visiting in this part of the Dominion, speaking of electric street-railway systems, stated that the net profits for last year of the Glasgow tramway, which is operated by the city, amounted to $500,000, which represented about one-quarter of the total receipts of that railway. The fare charged was one cent for the first half mile traveled by a passenger, and another cent for each mile of the road he may continue to traverse thereafter. Mr. Fraser expressed a favorable opinion of the American plan of a uniform fare, but claimed that the other system was not without its advantages in many respects.

The construction work on the Metropolitan Electric company's water-power project at Britannia village, eight miles distant from Ottawa, is progressing with all the rapidity which the nature of the undertaking allows. The whole work is to excavate a canal out of the living rock, over a quarter of a mile long, 150 feet wide at its narrowest part and with a depth of 14 feet. To do this necessitates the removal of 100,000 cubic yards of solid rock. The canal runs parallel with the rapids, and with but a few feet of rock between the two. W.

PERSONAL.

Mr. Samuel Insull, president of the Chicago Edison company, is in the East on a business trip.

It is again reported that Signor Marconi, the renowned inventor, will visit the United States this fall.

Peter J. Bourscheidt, secretary and treasurer of the Eagle Electric Works of Peoria, was a Chicago visitor last week.

Charles W. Lorrens, an electrical engineer of London, Eng., is in Pittsburg, visiting the large electrical establishments.

Mr. Edward L. Barr, secretary of the Wallace Electric company of Chicago, is spending a short vacation in Wisconsin.

Mr. Jesse Spalding, president of the Chicago Union Traction company, with Mrs. Spalding, is spending his vacation on the seashore in Massachusetts.

Dr. Price E. Murray, a telegrapher of 30 years' experience, but also a regularly graduated physician, has been appointed manager of the Atlanta office of the Western Union Telegraph company.

Dr. Elisha Gray is the author of a popular work, "Nature's Miracles," about to be issued in three volumes by an eastern firm of publishers. Scientific subjects are considered in a series of "familiar talks" in these books, the third volume being devoted to electricity and magnetism.

Mr. Arthur Warren of the Westinghouse Electric and Manufacturing company recently passed through New York, on his way home to Pittsburg, after spending several months abroad. Mr. Warren went to England in company with Mr. George Westinghouse early in the summer, and while at the time the object of this mission was not generally known, the establishment of the Westinghouse interests in England shows that their journey was not without results of great consequence.

It is said that among those who will oppose municipal ownership at the Syracuse convention of the League of American Municipalities, September 19th to 22d, will be M. J. Francisco of Rutland, Vt., ex-president of the National Electric Light association, and H. L. Doherty of Madison, Wis., president of the Northwestern Electrical association.

Isaac L. Rice has resigned the presidency of the Electric Storage Battery company of Philadelphia, and George H. Day, formerly the first vice-president, has been elected by the directors as his successor. Mr. Rice said that he had found it absolutely impossible to devote the necessary time to the details of a manufacturing business so extensive as that of the company. He remains a member of the board and retains his large holdings. He continues also to be president of the Electric Vehicle company and the Chicago Electric Traction company.

ELECTRIC LIGHTING.

Tuscumbia, Ala., has granted a franchise to W. H. Sawtelle and associates for the construction of an electric-light plant and waterworks.

The proposition to bond the city for $75,000 to build a system of waterworks and to buy an electric-light plant recently passed at Dillon, Mont.

The War Department is inviting sealed proposals, until September 8th, for installing an electric-light plant at the West Point Military Academy. Blanks and instructions will be furnished intending bidders upon application to the quartermaster, U. S. M. A., West Point, N. Y.

The recently elected directors of the Phœnix (N. Y.) Electric Light company are, Robert S. Sloan, S. Dana Greene, E. S. Tifft, O. F. Gaylord and Elisha B. Powell. The following-named officers were elected: President, Robert S. Sloan; secretary and treasurer, E. B. Powell.

ELECTRIC RAILWAYS.

An electric railway is to be built from Salt Lake City to the La Sal country, in Southeast Utah, by the Huntsman Copper Mining company.

The Mount Lowe (Cal.) railway is to be extended to the summit of the mountain. A corps of engineers will be put in the field within a short time to survey the route of the road. With the completion of this road the company will have in operation fully 11 miles of mountain railway, being the longest electric mountain railway in the country.

Charles T. Yerkes has been elected president of the Chicago Consolidated Traction company, vice John M. Roach, resigned. L. S. Owsley has succeeded W. F. Furbeck as vice-president, and the following changes have been made in the directory: John R. Walsh, B. B. Lamb and Harvey T. Weeks elected to succeed John M. Roach, D. H. Louderback and C. H. Marlowe. These changes are in line with the announcement some time ago that Mr. Yerkes, having freed himself of the management of the North and West Side roads, would devote his energies to the building up of the outlying lines.

Mayor Maybury's plan to demand eight tickets for a quarter in compliance with the amended street-railway ordinance in Detroit has been frustrated. The street-railway people went into the United States District Court with a bill of complaint that the ordinances are a violation of contract, and on that showing secured from Judge Swan a restraining order temporarily holding up the enforcing of the ordinance. The restraining order stops everything as absolutely as the injunction would. On September 4th the court will listen to argument as to why a preliminary injunction should not be issued.

AUTOMOBILES.

It is reported that capitalists are planning to build an automobile factory, with a capacity of two vehicles a day, at Napa, Cal.

The English Automobile and Motor company of Chicago, Ill., has been incorporated, under the laws of West Virginia, with a capital of $5,000,000.

A large tract of land in Lynn, Mass., with the manufacturing buildings thereon, has been purchased by the Equitable Auto-truck and Power company of Boston. It is the intention of the company to erect at once one of the largest and best-equipped malleable-iron and forge plants in New England.

For some time an electric hose carriage has been in use by the fire department in Paris. The machine weighs over a ton, or, with equipment, nearly three tons. The equipment consists of six men, apparatus to operate three lines of hose, a scaling ladder, apparatus for fire in cellars, and one for life-saving purposes. It can travel 15 miles an hour on good roads, and there is no delay in starting out. An electrically propelled steam engine and a hook-and-ladder truck are now being constructed for experimental purposes.

The Davis automobile, which started some time ago on a cross-continent trip, and which has suffered more than its share of misfortunes and accidents, has reached Toledo, and is now waiting in that city for repairs and the settlement of an attachment served on the vehicle by a dry-goods firm in Connecticut.

It is stated that an automobile system will soon be in operation in Cleveland. The scheme will be to run the automobiles on schedule time in competition with the street-car lines. The vehicles used will be covered and will be heated in cold weather. It is expected that a number will be in operation within 60 days.

The United States Express company has successfully tested a new electric automobile express wagon in New York city. Similar tests have recently been made in Chicago, Philadelphia, Baltimore and Washington, and the company now intends to place the new vehicles in regular operation in all the chief eastern cities.

The automobile parade that is being planned at Newport will be held on the evening of September 7th. Mrs. Herman Oelrichs, who has had the matter in charge, has been making the final arrangements, and it is expected that every horseless carriage in the city will be in line. The event promises to be an interesting feature of society life in Newport.

The German minister of war is authority for the statement that the automobile is being closely watched by military men, with the hope that it can be used in warfare, especially in those countries where the roads are good, for the transportation of supplies and for ambulance service. Animals are always in the way in war, and when they can safely be replaced a great stride will have been taken.

The Automobile Club of America has been incorporated in Albany. George F. Chamberlain is the acting president and Homer W. Hedge the secretary. A clubhouse where non-resident members can be entertained and a stable for the housing of the automobiles are planned. The most important work of the club will be the active part it purposes taking in legislation for good roads. This will be national in its character. It will seek to protect the interests of automobile owners everywhere. The club has already been recognized by similar organizations that have been chartered in Great Britain, France, Germany, Austria, Switzerland and Belgium.

PUBLICATIONS.

"The Single-phase Alternating-current Motor" is the title of a 12-page illustrated article that appeared in the May issue of the Rose Technic, and which has been reprinted and is now being sent out to the trade by the Wagner Electric Manufacturing company of St. Louis. W. A. Layman presented the paper to the students of the Rose Polytechnic Institute, Terre Haute, and made special reference to the Wagner single-phase motor, describing it in detail.

A catalogue upon underground electric haulage has been issued jointly by the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing company. Electric mine locomotives produced by such prominent manufacturers cannot fail to interest all mine proprietors who study economy in operating expenses. The catalogue illustrates and describes the locomotives and contains tables of dimensions and of the hauling capacity upon various grades.

The latest bargain sheet of Thompson, Son & Co., 107 Liberty street, New York, has been issued in the shape of a little booklet. It contains a long list of bargains in electrical apparatus, including incandescent and arc lamps, dynamos, motors, railway generators, arc machines, transformers, ammeters, voltmeters, lightning arresters, alternators, engines, street cars, etc. It is the aim of the company to supply the electrical trade with dynamos, motors and engines and parts and pieces on short notice, and it claims to be able to furnish promptly nearly everything used in railway, power or lighting plants, at low prices.

TELEGRAPH.

The Old-time Telegraphers' association and the United States Military Telegraph corps have issued their programme for the nineteenth reunion, which will take place in Boston September 12th, 13th and 14th. The headquarters will be at the Copley Square Hotel and Hotel Nottingham, which adjoins. On Tuesday, September 12th, at 9 a. m., the business meeting of the Old-time Telegraphers' association will take place, and at 11 a. m. the business meeting of the United States Military Telegraph corps. Members who expect to be present are requested to notify Mr. Grant H. Yetman, No. 234 Devonshire street, Boston, Mass. Mr. Yetman is secretary of the entertainment committee.

MISCELLANEOUS.

A very unique and appropriate invitation is being sent out to the electrical fraternity by Eugene F. Phillips, general manager of the American Electrical Works of Providence, R. I. It is printed on a thin sheet of rolled copper and invites the recipient to the 21st annual Rhode Island clam dinner to be given by Mr. Phillips at the Pomham Club of Providence on September 9th.

The Scott-Janney Electric company was recently incorporated in New Jersey with an authorized capital stock of $30,000,000, of which $15,000,000 is to be preferred stock bearing seven per cent. non-cumulative dividends. It is said that among the objects of the company are the construction and operation of direct and alternating-current railways and railway apparatus, the carrying of passengers and transportation of freight by land or sea; the operation of shipyards, canals, waterways, mines and factories of all kinds, and the development of electricity in any of its forms.

TRADE NEWS.

The Chicago Mica Mining and Milling company of 1232 Monadnock building has been organized as an independent mica company, outside of the companies mentioned as forming the mica trust.

The New York office of the Electric Storage Battery company, in charge of Charles Blizard, has been moved from 20 Broad street to the fifteenth floor of the American Surety building, 100 Broadway.

The Northern Electrical Manufacturing company of Madison, Wis., which installed the interesting plant in the Fish Bros. Wagon company's factory at Racine, has recently closed a similar contract for the engineering work and electrical equipment at the establishment of the Emerson Manufacturing company of Rockford, Ill.

A press dispatch from Eau Claire, Wis., states that the trial of Harrigan and others against the National Electric Manufacturing company was begun in the Circuit Court in that city on August 21st. The pending action involves about $100,000. The complaint alleges "conspiracy" in winding up the affairs of the company, and the plaintiffs seek to reopen the receivership and cause large sums of money to be paid back into court, and also seek to hold stockholders liable upon dividend stock issued to them, such stock having been issued on the supposition of the existence of profits.

The business revival has brought to the front a number of new concerns in the electric business, and one of the latest to enter the incandescent-lamp field is the firm of McLaren & Goodchild of Newark, N. J. This concern is now manufacturing an incandescent lamp that should meet with great success. The company's factory is in Newark, where it is rapidly increasing its facilities for turning out a high grade of incandescent lamps. This firm will employ no "army" of salesmen, for Mr. Goodchild, the courteous "business man" of the firm, will alone look after the outside interests of the concern and handle the output. It is figured to save in this way on exploiting expenses, in order that a corresponding reduction may be made in the price of the product. Mr. McLaren will do the expert work for the institution and attend to the turning out of the lamps, for which his long experience eminently fits him. The new lamp is said to be worthy of careful investigation on the part of buyers.

The Western Electrical Supply company of St. Louis, Mo., general selling agent for the Adams-Bagnall enclosed incandescent arc lamps, is elated over the recent lamp tests conducted by the electrical department of the Ohio State University. After a series of the most exhaustive tests as to efficiency, mechanical construction, general design and adaptability, the Adams-Bagnall lamp is stated to have shown itself to be ahead of all others, making the general average of 97.1, 100 being perfect. The figures for the remaining seven of the lamps in competition are given as follows: 87, 88.7, 92.6, 93.3, 89, 92 and 90.2 per cent. These tests were conducted not only for scientific purposes, but it was the intention of the university to purchase quite a number of the lamps which proved themselves the best. After the showing made it is needless to say that the contract was awarded to the Adams-Bagnall company. This test seems to corroborate what has always been claimed for this lamp, that it is the best, most up-to-date and mechanically perfect arc lamp on the market to-day. Circulars, descriptive matter and prices will be mailed upon application.

Friends of Fred M. Locke of Victor, N. Y., will be glad to learn that the controversy over the inventorship of the insulator manufactured by him, and comprising two or more shells of porcelain nested together and fused together with glaze, has been decided by the examiner in the Patent Office in his favor. Mr. Locke filed his application for letters-patent in February, 1897, and in August of the same year Mr. Boch, of the R. Thomas & Sons company of East Liverpool, O., filed an application for the same thing. An interference was declared between the two applications, and also between Mr. Locke and a patent granted March 8, 1898, to Mr. Boch, which comprises substantially the same invention, except that the parts were fused together with extra glaze. Interference proceedings have been pending since September, 1897, and the examiner has now decided that Mr. Locke has proved "that Locke was the first to conceive, disclose and reduce to practice the invention in issue. Judgment of priority is awarded to Fred M. Locke." In the second interference with the patent of Mr. Boch, the examiner held that "whichever party is entitled to prevail as to the issue in one interference is equally entitled to prevail in the other; the fact in this instance, the burden of proof is upon Locke, and that Boch is the patentee, is of no moment, for to the examiner's mind Locke has established his claims of priority beyond a reasonable doubt. Judgment of priority of invention is awarded to Fred M. Locke."

BUSINESS.

Special privileges are announced in a circular issued by the International Correspondence Schools of Scranton, Pa., to all who enroll before October 1st.

The Electric Appliance company, Chicago, attributes its success with Noxall annunciators to two points—simplicity of construction and price. A circular gives a very good description of this instrument.

A contract was recently closed by the E. P. Allis company of Milwaukee with the Glasgow Corporate Tramway management for six large engines that will be used in connection with the operation of electric street railways in the Scottish city. Four of the engines are to be 4,000 horse power each and two of 2,000 horse power each. The cost of the engines will be about $500,000, and it will be a year and a half before they are finished and installed. There was the sharpest competition among builders for the contract, and the success of the Allis company shows that the American builders can compete successfully with English factories on the home ground of the latter. This contract makes $2,000,000 worth of machinery that the Allis company is building for British companies.

It is very pleasing to Gates & Randolph, the western agents for such well-known concerns as the Triumph Electric company, Warren Electric Manufacturing company, Empire Electrical Instrument company, F. A. La Roche & Co. and the Sterling Arc Lamp company, to experience such a large demand for the apparatus handled by them. The firm has been especially successful in placing the well-known Empire voltmeters, ammeters and other electrical instruments, which have been installed in many of the plants erected in the central and western states during the last six or eight months. It is claimed that the Empire instruments possess many points of superiority over old-style instruments. Each instrument is enclosed in an iron, dustproof case, which also performs the function of a shield against outside electrical influences. The instruments are said to be free from friction errors, dead-beat, sensitive and extremely accurate. They are made for both alternating and direct current.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 15, 1899.

630,840. Apparatus for Measuring Electric Currents. Hermann Aron, Berlin, Germany. Application filed December 30, 1897.

This is an apparatus for separately measuring electric currents which are alternately flowing in opposite directions, comprising two recording devices, each turning but in one direction and locked against turning in the other direction, the recording devices being separately actuated by a common shaft.

630,841. Combined Telegraph and Telephone. Robert M. Bailey, Williamsport, Pa., assignor to the American Bell Telephone company, Boston, Mass. Application filed June 10, 1899.

The combination with a telegraph sounder of the electrodes of a microphone in a telephone circuit, the telegraph sounder and one or both of the electrodes of the microphone being mounted upon the same base or plate.

630,852. Locking Hanger for Electric Arc Lamps. Jas. A. Brennan, Worcester, Mass., assignor to the Worcester Electric Light company, Worcester, Mass. Application filed May 24, 1897.

A hanger is described, having a locking sleeve and nut to hold the lamp hook immovable.

630,857. Alarm Device. William C. Brumder and John Rogginger, Milwaukee, Wis. Application filed September 19, 1898.

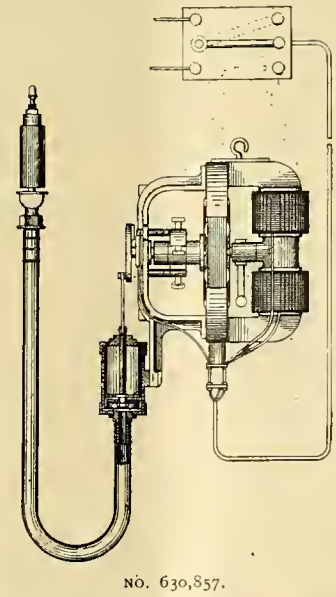
The inventors describe an alarm device, comprising a whistle adapted to be sounded by fluid medium, a device for supplying the medium to and of forcing it through the whistle, an electric motor connected by an electric conductor to a power supply, the motor being adapted for operating the device applying the medium to and forcing it through the whistle, and a switch or electric power-supply controlling means at a distant locality in the electric circuit adapted under the control of the attendant for putting the motor and whistle into operation at the distant whistle locality. (See cut.)

630,905. Electric Arc Lamp. Philip Luhr, Orange, N. J., assignor to the Manhattan General Construction company of New York. Application filed August 17, 1898.

An arc lamp is described having a magnet coil supported above a floor upon feet or spacing blocks, in combination with an armature, an air space being provided between the coil and armature.

630,927. Surface-contact Railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 16, 1898.

The method of insuring the prompt closing of the successive switches in a surface-contact railway system, which consists in closing a switch at full current and increasing the resistance in the circuit of the switch until the shoe makes contact with the switch in advance of the one already closed, thereby diverting to that switch the greater part of the current and insuring its closing.



No. 630,857.

630,930. Armature. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 20, 1898.

The combination with the armature iron of a dynamo of an end ring, a space block between the ring and the armature iron provided with radial spaces to promote ventilation, and an overlapping edge to prevent radial displacement under centrifugal strain.

630,938. Controlling Mechanism for Electric Railways. Sidney H. Short, Cleveland, Ohio, assignor to the Walker company of New Jersey. Application filed December 7, 1898.

In a pneumatic controlling mechanism for electric railway cars is combined a controller and a reversing switch, and pneumatically operated means for actuating the reversing switch in advance of the actuation of the controller.

630,939. Controlling Mechanism for Electric-railway Cars. Sidney H. Short, Cleveland, Ohio, assignor to the Walker company of New Jersey. Application filed December 7, 1898.

In this mechanism, which is pneumatically controlled, is combined a controller and means for actuating the same a lock for arresting the controller and pneumatically actuated means for releasing the lock.

630,953. Automatic Regulator for Electric Currents. Adolf Vogt, Budapest, Austria-Hungary, assignor to Fritz Back, Budapest. Application filed May 8, 1899.

The regulator comprises two converging planes, a thermal wire laid thereon, means for including the wire in an electric circuit, and means acting upon the thermal wire at the point where it bridges the proximate edges of the planes to move the wire as it expands under the action of heat away from the planes.

630,966. Carbide Furnace. Ludwig K. Böhm, New York, N. Y., assignor to the Electro Gas company of West Virginia. Application filed June 15, 1896. Renewed May 25, 1898.

In a carbide furnace, the combination of the upper electrode, a carbide tank provided with grooves in the bottom thereof, a supporting plate for the tank arranged at an incline and provided with ribs corresponding to the grooves, a plate attached to the supporting plate for carrying the current cables, and carbide placed on the bottom of the tank for forming the surface of the lower electrode.

630,974. Electric Block-signaling Apparatus. Henry H. Creamer, Millbury, Mass. Application filed April 7, 1899.

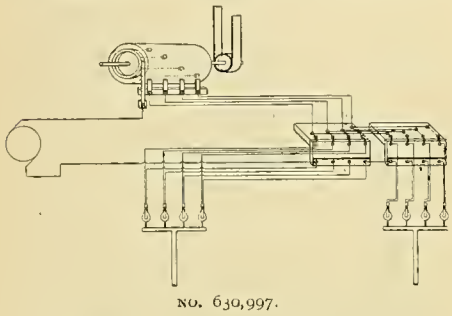
An electric block-signaling apparatus for railways is described comprising two or more signals at each end of a single-track section, between two turnouts or double-track sections, two switches at each end of the single-track section, and switch-operating mechanism at each end of the section, wires connecting the signals and switches, to cause a signal to be given at one end of the single-track section and a different signal to be given at the other end thereof, as a car enters on either end thereof, and the signal at one end to be repeated by a car following, and another signal given at the other end.

630,997. Apparatus for Exhausting Electric Lamps. Walter F. Smith, Philadelphia, Pa., assignor to the United Electric Improvement company, Gloucester City, N. J. Application filed March 1, 1899.

Means for exhausting lamp bulbs which comprise an exhaust connection communicating with a group of lamps, a source of current, and a switch and its circuit connections for successively cutting each lamp of the group into and out of circuit. (See cut.)

631,015. Electric-railway System. Joel G. Justin, Syracuse, N. Y. Application filed July 26, 1897. Renewed January 20, 1899.

The system comprises a conduit, a conductor in the conduit, a contact rail, an oscillating frame supported on the conductor, and consisting of arms pivoted on the conductor, the arms being connected by a strip of magnetic metal which carries a contact point connected with the conductor.



NO. 630,997.

631,023. Telephone-toll Apparatus. Morris C. Mengis, Baltimore, Md. Application filed September 13, 1889.

The apparatus combines a coin chute, a pivoted coin lever having one end under the exit end of the chute, and a bridging contact on the other end, contact blocks over the bridging contact to limit the movement of the lever and prevent the coin resting on its other end from passing off and out of the chute, a call circuit including the contacts, and a support for the contact blocks raised by the receiver hook, when the receiver is placed on the latter. (See cut.)

631,024. Mechanical Depository. Morris C. Mengis, New York, N. Y. Application filed September 10, 1898.

The depository has in combination a main shaft carrying several gears, arms mounted on the shaft and provided each with a solenoid the core of which is arranged to be engaged with the corresponding gear, a source of electric energy, and means for completing the electric circuit in which the solenoid is located by the intervention of a coin therein.

631,032. Electric Alarm and Registering or Controlling Apparatus. Max Vester, Leipsic, Germany. Application filed October 29, 1897.

This is an electrical alarm or signaling system combining a series of signaling circuits, a series of push buttons at a central station to complete the several signaling circuits, a movable plate covering all of the push buttons, one or more levers connected to the plate to move the same to actuate all of the push buttons, and spring-actuated pawls attached to a fixed support, the pawls automatically engaging the plate when it is pushed inward, to lock all of the push buttons in closed position.

631,037. Electric Appliance for Controlling Supply of Gas to Burners, etc. Carl Franzen, Cologne, Germany. Application filed February 20, 1890.

An igniting apparatus for electrically operated incandescent gas burners which combines with the burner electromagnetic means for controlling the flow of gas thereto, a socket provided with electrical contact parts in electrical connection with the means, and an igniting device comprising a stem with coacting contact parts adapted to be removably inserted within the socket, and an igniting conductor electrically connected with the contacts and carried at the upper end of the stem centrally within the flame.

631,040. Process of Extracting Precious Metals from Their Ores. John E. Greenawalt, Denver, Colo., assignor of one-half to William Robinson, Denver, Colo. Application filed April 14, 1898. Renewed January 17, 1899.

An electrolytic process for the treatment of gold and silver ores is described.

631,044. Standard Voltaic Cell. Richard O. Heinrich, Berlin, Germany, assignor to the Weston Electrical Instrument company, Newark, N. J. Application filed April 4, 1899.

The cell has liquid electrodes, a diaphragm located above each electrode and separating the same from the electrolyte or battery solution, each diaphragm being secured to a vent tube which extends above the electrolyte or battery solution, in combination with means at the top of the cell for securing the vent tubes directly thereto.

631,055. Electric Arc Lamp. Christian J. Toerring, Philadelphia, Pa. Application filed November 5, 1898.

An arc inclosure having a light-transmitting portion closed at the bottom and a heat-retaining portion closed substantially air-tight at the top and shaped to inclose the carbon pencil, the joint between these portions permitting the passage of a minute quantity of air.

631,070. Sound-locating Device. Alfred M. Goodale, Waltham, Mass. Application filed August 21, 1986.

A device comprising the combination of two or more sound-collecting devices, a telephone transmitter for each of such devices, a telephone receiver connected with all of the several transmitters, and a switch interposed between the transmitters and the receiver and adapted to be operated by the user of the receiver to ascertain the relative activity of the transmitters.

631,073. Contact System for Electric Railways. William Grunow, Jr., Bridgeport, Conn., assignor of two-thirds to James H. McElroy, Bridgeport, Conn., and Joseph A. McElroy, New York, N. Y. Application filed February 3, 1899.

A contact system embodying twin working conductors, a contact receptacle bonded to one member thereof, an electromagnet movably mounted in the receptacle having an energizing winding or coil connected with the other member of the conductors, and track or service rail and flexible conductors connected with the electromagnet and source of electrical supply, whereby the device is raised into contact with the receptacle when the circuit is closed through the energizing coil and the bonded member of the working conductor is charged with the supply current.

631,081. Mouthpiece for Telephones. Albert Laemmel, New York, N. Y., assignor to John V. Luff, New York. Application filed April 28, 1899.

A removable lining adapted to fit within the mouthpiece of a telephone, and molded or formed of one piece of celluloid, the lining being of substantially the same shape as the mouthpiece to which it is fitted, and provided upon its larger outer end with a curled flange to removably hold it in place.

631,112. Electrician's Tool. Daniel S. Geiser, Waynesborough, Pa. Application filed April 8, 1898.

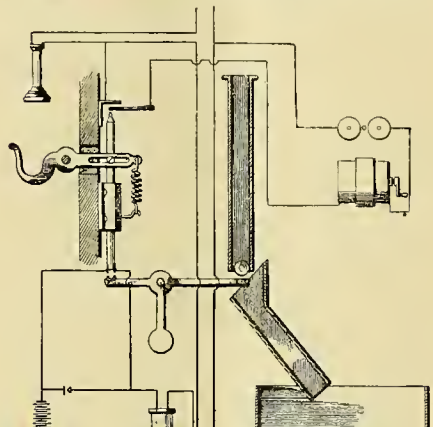
A tool having fuse-wire spools or carriers detachably connected therewith and feed grooves for the wires, relatively so arranged that the wire can be fed at right angles from the spools, lengthwise from the front end of the tool.

631,132. Telegraph Switchboard. John F. Skirrow, East Orange, N. J. Application filed April 11, 1899.

A flexible connecting cord for uniting electric circuits, consisting of an insulated conductor, two sliding sleeves located thereon, a ring or eye on each sleeve through which the cord passes and suitable terminals or pins for each end of the cord.

631,134. Electrically Operated Railway-crossing Alarm. Joseph E. Steele, Columbus, Ohio. Application filed May 8, 1899.

The invention consists of an electrically operated alarm bell to be connected with sections of a railway track at crossings and so designed as to signal the approach of trains.



NO. 631,023.

631,145. Electric Safety Appliance. Franklin H. Badger and William J. Plews, Montreal, Canada, assignors of one-third to Robert Edmund Thomas Pringle, Montreal, Canada. Application filed January 30, 1899.

An automatic safety switch, combining with a main circuit and a local circuit, separated one from the other, a spring-operated switch, adapted to connect the flow and return wires of the separated circuits, and a protective circuit, separated from the local circuit by a high-resistance medium and containing electromagnetically operated means for automatically releasing the switch, the means comprising independent magnetic coils operating upon a common trip, whereby the local circuit, including the operating device itself and the protective circuit, is disconnected from the main circuit.

631,150. Telephone Circuit. Hermann Brockelt, Dresden, Germany. Application filed April 6, 1898.

A telephone system is described having in combination a main circuit leading to ground, a pair of receivers in the main circuit, a microphone, a battery, an induction coil having its primary in circuit with the battery and microphone and its secondary in the main, and a second induction coil having its primary in the main circuit and its secondary in a branch of the circuit with the receivers.

631,162. Electrically Operated Cock and Igniting Device. Paul L. Guyenot, Paris, France. Application filed June 9, 1899.

An electrically operated cock, having a plug and a valve seat for the plug, electromagnetic means for lifting the plug off its seat, magnetic means to then rotate it, and then allow it to drop onto its seat again at a different relative peripheral position.

631,165. Trolley. Herbert Hirschman, Salt Lake City, Utah. Application filed March 29, 1899.

A trolley wheel and its support are combined with guard-fingers, each pivotally mounted between its ends above the wheel and extending transversely over a portion of the wheel, the inner ends of the guard-fingers normally overlapping, and springs connected with the outer ends of the fingers and with a fixed support, the fingers being capable of lateral movement and held against vertical movement.

631,167. Telephone System. Malcolm S. Keyes and James H. Spencer, New York, N. Y., assignors to Spencer & Co., New York. Application filed January 3, 1899.

A telephone system comprising a plurality of stations, an induction coil having one end of each of its coils connected to a line wire leading to all the stations, the other end of the primary having connect on with a battery and with a second line wire connecting with the calling device at each station, and the other end of the secondary coil having connection with a third line wire in which the receivers of the several stations are arranged, and transmitters in the signal circuit, the battery, primary and secondary circuits being completed by removing the receiver at any one station.

631,173. Attaching Plug for Flexible-wire Connections. Daniel McGlone, New York, N. Y. Application filed March 7, 1899.

The plug comprises a metallic plug arranged for attachment to the supporting fixture connected with one of the line terminals, and a carrier of insulating material mounted to turn on the plug, and carrying two circuit conductors for the wires, one conductor being in contact with the plug and the other being arranged for contact with the other line terminal.

631,191. Storage-battery Cell. Axel K. Westerdahl, New York, N. Y. Application filed June 24, 1898.

A battery-cell cover is described comprising an elastic or yielding marginal portion having openings admitting the battery-element studs or projections and also having a central opening, and a harder interior portion adapted to forcibly enter the central opening and thereby expand the marginal portion by direct lateral pressure to the cell walls and element studs.

631,221. Incandescent Lamp. Edmund C. de Marcay, Paris, France. Application filed September 13, 1898.

An incandescent electric lamp having a vacuum bulb and a hollow reflector tube inside the bulb with open communication between the interior of the tube and the interior of the bulb.

631,222. Submarine Photographic Camera. David Mason, New York, N. Y. Application filed November 11, 1898.

One claim reads: An apparatus for photographing bodies or surfaces beneath water, consisting of a camera having its parts protected from the water and provided with electromagnetic means for holding it against the side or bottom of a vessel or surface to be photographed; in combination with an electrical source of illumination for illuminating such parts or surfaces, together with electromagnetic means for controlling the movements of the camera shutter.

631,225. Electric Meter. Granville F. Packard, Fort Wayne, Ind. Application filed October 10, 1898.

An electric meter or motive device for alternating currents is described having a laminated field-magnet structure comprising five polar projections integral with a magnetic yoke.

631,234. Cleat for Electric Wiring. Henry M. Stevens, Boston, Mass., assignor of one-half to the Pettingill-Andrews company, Boston. Application filed January 16, 1899.

A wire-supporting cleat consisting of two members between which the wire is held, each member having a hole therethrough and an upturned hollow boss on its inner face, the boss of each member snugly fitting the hole in its juxtaposed fellow.

631,238. Motor Apparatus. John E. Tyler, Roxobel, N. C. Application filed June 6, 1898.

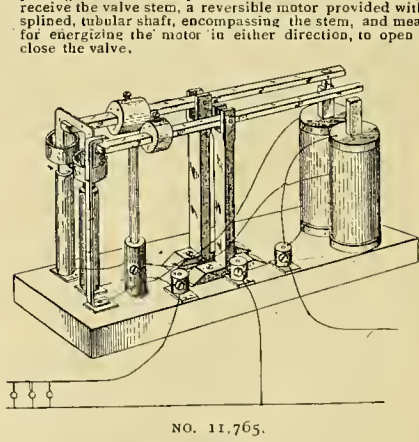
Electrically operating devices for operating the feed valve of a hydraulic apparatus are described.

631,253. Process of Reducing Aluminum. Frank A. Gooch, New Haven, Conn. Application filed April 29, 1899.

The process consists in forming a bath by fusing together a suitable compound of aluminum and a suitable halogen compound of a metal more electropositive with reference to sulphur than is aluminum, adding to the bath a suitable compound of sulphur together with alumina, and then passing an electric current of suitably low voltage through the fused mass, thereby electrolyzing the same.

631,263. Electrically Operated Gate Valve. Louis E. Walkins, Springfield, Mass., assignor of one-fourth to Francke W. Dickinson, Springfield, Mass. Application filed December 20, 1898.

The combination with a valve and its threaded stem, provided with a longitudinal keyway, of a hook encompassing the valve, and provided with a threaded orifice, to receive the valve stem, a reversible motor provided with a splined, tubular shaft, encompassing the stem, and means for energizing the motor in either direction, to open or close the valve.



NO. 11,765.

REISSUE.

11,765. Controller for Electric Lights. Orra M. Lacey, Hanford, Cal. Application filed June 27, 1899. Original No. 625,571, dated May 23, 1899.

The combination of an electric circuit, lights in the circuit, and automatic make-and-break devices, whereby if more lights than a fixed number are traversed by the electric current, the lights will be alternately lighted and extinguished in rapid succession. (See cut.)

DESIGN.

31,410. Snap Switch-button. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed July 20, 1899. Term of patent seven years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, SEPTEMBER 2, 1899. No. 10

A Model Country Central-station Plant.

Edwardsville, Ill., the county seat of Madison County, is a prosperous town of 4,000 inhabitants, situated about 20 miles northeast of St. Louis. A new electric-light and power plant has been recently completed there and is now in successful operation. It has been pronounced to be one of the best constructed and most complete country electric-light plants in Illinois, and the added statement that it is the only fireproof plant in the state outside of Chicago adds special interest to it.

The building, shown in Fig. 1, is constructed of brick, with a steel-trussed roof, the construction being fireproof throughout. A brick partition near the center divides the structure longitudinally into two separate rooms. On the left, referring to the illustration, is the engine and dynamo room, 72 feet in length with a 36-foot frontage, while the room on the right, which contains the boilers, feed-water heater and pumps, is 33 feet wide and extends back 53 feet.

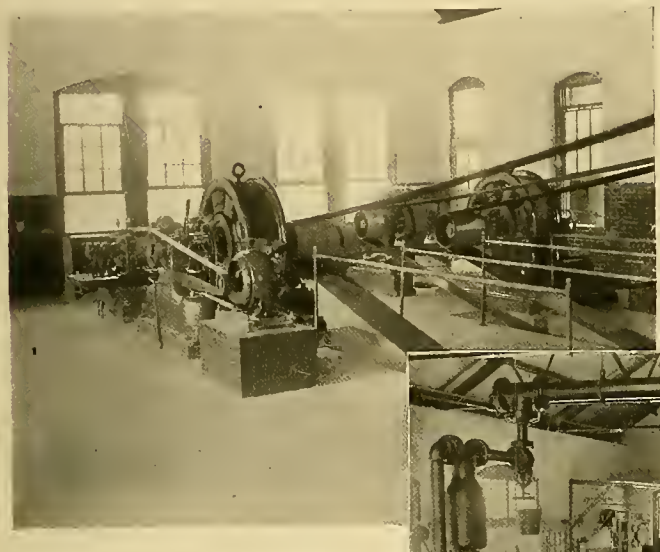


Fig. 3. Dynamos.

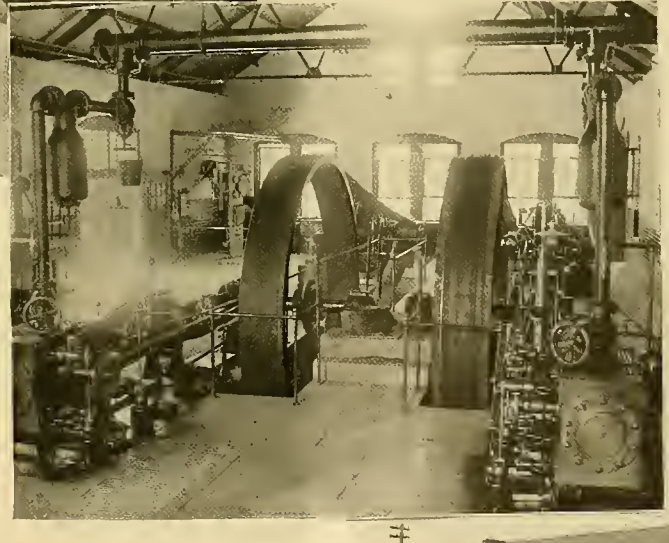


Fig. 2. Engines and Switchboard.

To avoid delay and trouble in case of a breakdown and to afford its customers a continuous service, the company, which is known as the Edwardsville Electric Light and Power company, has erected a duplicate plant. This idea has been followed out in the boiler room as well as the engine and dynamo room. There have been installed one large fine-tubular boiler and a battery of two smaller ones. Each of the smaller boilers is 60 inches in diameter and 16 feet four inches in length, there being a 28 by 30-inch steam dome over both. The large boiler has a diameter of 72 inches and is 20 feet six inches in length, with a steam dome 36 by 40 inches. Tuxhorn Bros., a local firm, built the two smaller boilers, while the larger one is from the works of John O'Brien & Co. of St. Louis. The two Tuxhorn boilers have about the same capacity, combined, as the O'Brien boiler, and either set will do the work of the plant.

There are installed in the engine and dynamo room two St. Louis Corliss engines, built by the St. Louis Iron and Machine Works. These engines, which are shown in Fig. 2, are duplicates, each having a 14 by 36-inch cylinder and a 12-foot driving pulley. They have been tested to give about 180 horse power each. An arc machine and an alternating-current generator, illustrated in Fig. 3, are belt-driven by each of the engines, the distance between centers of the engine and dynamo pulleys being 25 feet for the alternators and 33 feet for the arc machines. The alternators are of the General Electric type, are separately excited and have a capacity of 90 kilowatts each. They are used to supply the incandescent-light and power services, each alternator having a capacity of 1,800 lights. The two arc-lighting machines have a capacity of 50 and 60 lights respectively. One is a Brush machine and is shown on the extreme left of the view in Fig. 3, while the other is a Wood dynamo.

The switchboard, shown in Fig. 2, is of blue Vermont marble and was built by the General Electric company. There are the usual voltmeters, ammeters, switches and regulating devices, each dynamo having its separate instruments. There are separate circuits in the city for the meter, contract and power customers, any of which may be thrown on either alternator. The switchboard is also complete with detachable fuse plugs, ground detectors and circuit-breaker.

The exhaust-steam and water pipes are laid in trenches 18 inches wide, three feet deep and enclosed in nine-inch brick walls, covered with yellow-pine flooring. The exhaust steam passes through a Cochran heater to an iron tank 11 feet in diameter by seven feet in height, situated in the rear of the boiler room. From this tank the pipe is turned down and exhausted into a Worthington cooling tower. The water that is thus condensed from the steam falls into a pit, from whence it flows by gravity into a hot well, situated underneath the tank, into which it is pumped. It then flows to the Cochran heater and is pumped by one of two boiler-feed pumps back into the boilers. If the exhaust steam does not supply sufficient water in the tank the suction of the pump in what is called the pump house is diverted to a nearby pond and water is pumped direct from the pond to the tank. The arrangement of the pumps is such that either boiler-feed pump can pump water from the Cochran heater or the hot well or tank, and the cold-water pump can be utilized for a boiler-feed pump as well, and if all hot water is exhausted water can be drawn from the pond for the boilers in an emergency.

To celebrate the starting of the plant the company issued printed invitations to patrons and prominent citizens to visit the station. An attractive feature of the "opening" was a display of electrical cooking and heating apparatus. Refreshments, comprising coffee, biscuits, pancakes, etc., cooked by electricity, were served the guests. Electrically heated curling-irons, sad-irons, chafing-dishes and foot-warmers were also on exhibtion, besides electric motors and electrically driven fans.

The Edwardsville Electric Light and Power company has a capital stock of $20,000. The following-named gentlemen are the officers of the company: President, C. H. Fischer; secretary and treasurer, C. A. Vallette; manager, W. H. Vallette. Forty-five arcs and about 1,800 incandescent lights are supplied by the plant, so that each generating unit can carry the whole load.

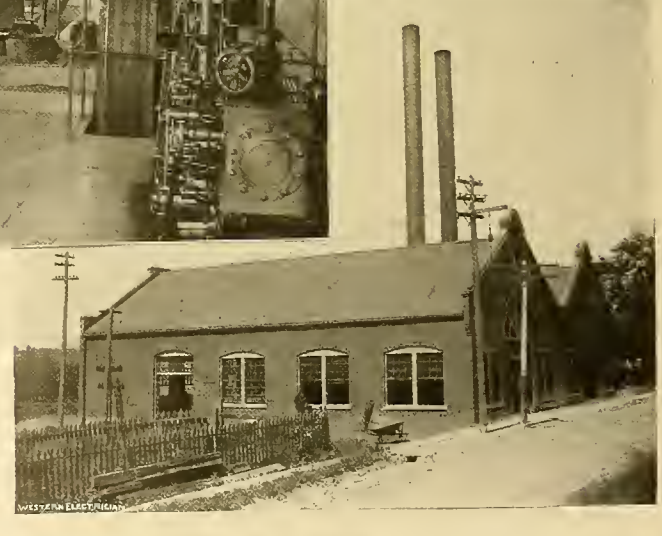


Fig. 1. Exterior View.

A MODEL COUNTRY CENTRAL-STATION PLANT.

Electric Lighting of the City of London.

Competition in the electric-lighting service of the city of London is sought by the Charing Cross and Strand corporation against the City of London Electric Lighting company, now doing the business. A select committee of the House of Lords is considering the application of the newcomer, and at a recent hearing some interesting testimony bearing on the peculiar conditions in the City was given.

Mr. Frank Bailey, engineer of the City of London company, gave evidence as to the peculiar difficulties connected with the supply of electricity in the city. The company had a larger percentage of the lamps connected with its system lighted at one time than any other company, reaching no less than 60 per cent., whereas 33 per cent. was nearer the ordinary figure. It was, therefore, necessary to have twice as much plant available to supply the same number of lamps as in an ordinary area. The demand for light in the city increased at a very rapid rate, but only lasted a short time. If his company were discharged from the burden of making the large provision for depreciation and reserve funds, as was stipulated for in the contracts with the corporation, it could supply electricity at 10 cents per kilowatt-hour.

Mr. D. J. Ross, engineer to the City corporation, said he had large experience in laying electric and lighting mains in the City of London. The whole of the City streets were very much congested with mains and pipes of various kinds, and in nearly all the great thoroughfares it would be impossible to put further pipes under the pathway, and any new pipes would have to be laid under the carriage-way to the great confusion of the traffic.

Lord Kelvin said he had had a long experience with electrical matters. There were two unusual circumstances connected with the supply of electricity in the City of London, the extreme rapidity with which the demand increased and the short time the demand lasted. The excessive amount of machinery required was hardly profitable during the summer months; in fact, was worked at a loss. Double the quantity of machinery was required for the City lighting to what was necessary in ordinary localities for the same number of lamps. The effect of competition would be very disastrous and exceedingly wasteful. The difficulties of supply would be only increased by dividing the responsibility between the two companies. Duplicate expenditure in plant and mains would become necessary, and the public must eventually suffer from this unnecessary expense. He believed the inevitable result would be the buying up of one company by the other, or both companies by the corporation, and that much greater expense would thus be incurred.

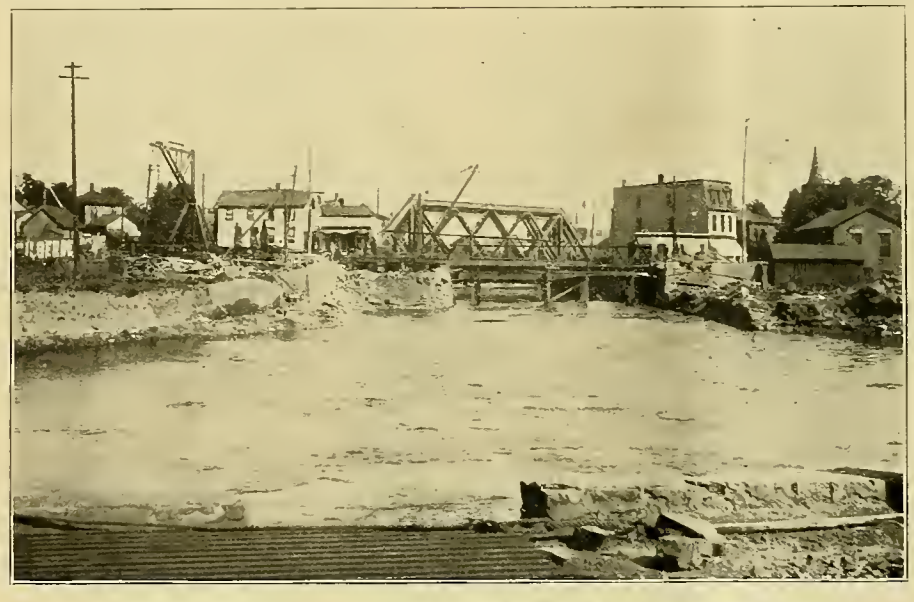
Henry Lyon, a Scotch electrical engineer, is said to have completed an electrical refrigerator.

Extensions at Niagara.

By Orrin E. Dunlap.

The Niagara Falls Hydraulic Power and Manufacturing company is doing a large amount of work on its property this year, and the result will be that its output capacity will be materially increased. This company owns the surface canal that conducts water from the upper Niagara River through the city to the edge of the high bank, where it is supplied to penstocks, which in turn supply wheels located in the power house at the water's edge. Ever since last spring the company has had a large force of men operating drill boats, dredges and scows in the enlargement of this waterway, so that the amount of water that flows through it to the canal basin is greatly increased. Of late the main base of operations has been below Main street, at which point a fine new steel bridge has been erected in order that the canal might be widened to full 100 feet. From this bridge down the width of the waterway has been extended and the walls carried back, so that the basin of old has been turned into quite a bay. It is from this basin that the forebay at the edge of the high bank is supplied by connecting canals, the penstocks leading from the forebay. The results accomplished should have a beneficial effect, so far as bother from the ice in winter is concerned. Last winter there was no little trouble in the basin from the ice.

Down in the power house the scene is one of considerable activity, well representing the company's intention to keep in advance of the constantly increasing demand for power. In this station there are now in operation five wheels, four of them made by James Leffel & Co. of Springfield, O., and



EXTENSIONS AT NIAGARA.—WIDENING CANAL AND BASIN OF HYDRAULIC POWER COMPANY.

one by R. D. Wood & Co. of Philadelphia. The Leffel wheels operate generators that supply the lower works of the Pittsburg Reduction company, the Niagara Gorge road, the Lewiston and Youngstown road, the Alloy Smelting Works, and also other consumers. The single wheel of R. D. Wood & Co. operates a generator that furnishes current to the National Electrolytic company and also a dynamo of the Buffalo and Niagara Falls Electric Light and Power company for incandescent lighting. This wheel is located on the latest penstock erected, which has a diameter of over 11 feet. On this penstock there are still four valves for wheels, and these wheels are to be installed at once. One of the new turbines is already in position, and the second one is on the ground. The others are expected to arrive as fast as they can be erected. Two of the new turbines will be direct-connected to generators that will give an additional supply of current to the lower works of the Pittsburg Reduction company, the capacity of which has just been enlarged.

The National Electrolytic company is also enlarging its plant, and will very soon call for an increase of its current supply. This company is under the management of Mr. S. P. Franchot, and it has been most successful in the manufacture of chlorate of potash, so much so that it has been forced to keep increasing its factory facilities continuously. The Acker Process company's plant is going up rapidly, and early next spring, by the time the machines are installed to supply it, it will demand a large amount of electricity. While the plant that is now being built by this company is of good size, it is already announced that other buildings will be erected within the next two years, in order that the output capacity of the works may be very large. It is stated that the process used by this company is destined to revolutionize the manufacture of caustic soda and bleaching powder.

This brief review of the present and prospective demand for the power product of the Niagara Falls Hydraulic Power and Manufacturing company has to do only with the factories that are in sight, so to speak, and does not cover any negotiations which the company may have on hand with promoters of other industries who seek to locate on the lands of this company. Considering the present industrial activity in the United States, and especially about Niagara, this prospective and future consumption is a material factor of itself, and, of course, must be provided for.

In order to meet it the Niagara Falls Hydraulic Power and Manufacturing company has commenced excavating for the third section of its power station. This new section will be 100 by 60 feet in size, and its construction will make the total dimensions of the station 100 by 180 feet. This will complete the contemplated size of the station, and will bring it close up to the pulp mill of the Cliff Paper company. When it is built provision will be made for an electric elevator to carry passengers from the top of the high bank to the station, which will be a valuable addition to present facilities for reaching the power house. The installation which it is proposed to place in this new section will, so far as at present planned, be very similar to that in the present station, the output being direct current. Work on this addition will be pushed vigorously in order that it may be completed as early as possible.

As a still further and even more notable improvement, the Niagara Falls Hydraulic Power and Manufacturing company has in contemplation the erection of a fine new power house below the bank at the water's edge. It is likely that when it is built this new station will be located north of the present power house, beyond the Central flouring mills. This location will necessitate the extension of the canal basin some distance north of its present boundary, but the company owns all the land in the vicinity. It is intimated that when it is built this new station will perhaps supply alternating current, and that the units of development will be larger than at present. The chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company is Wallace C. Johnson, and it is under his supervision that the company's extensive plans are carried out. The expenditure which the many extensions and improvements call for represents a large investment, but Niagara Falls is fortunate in having ample capital back of its power development. Arthur Schoellkopf is the business head of the Niagara Falls Hydraulic Power and Manufacturing company, and he is a careful observer of all work done, while he keeps thoroughly posted on all new apparatus and the demands of manufacturers.

Opportunities in British Columbia.

"In looking for good markets for the surplus of our electrical manufactures," writes a Washington correspondent of the Western Electrician, "it is well to remember that there are golden opportunities lying right at our doors, and one of them is to be found in British Columbia, for which Vancouver is the principal inlet. It has been suggested by the United States consul there that it would be a good move to set up a sample room in that city similar in idea to those already set up in different countries, with more or less measure of success attending their introduction. If different manufacturers combine in these matters the individual expense is not heavy, and the results will redound to the benefit of all concerned. Among the things for which there may be found a good market in British Columbia at the present time are electrical apparatus for street-cars, motors, lights, etc."

Carson City, Nev., is to be supplied with electric lights from a plant on the Carson River at Empire.

Blondlot's Electric Meter.

A recent writer in l'Industrie Electrique describes an invention which was originally presented to the French Academy in 1898, but which has been perfected by E. Ducretet, and it is claimed to be both exact and unchangeable with time.

The apparatus is based in principle upon the oscillations of a movable bobbin through which a current is passing in a field produced by a second stationary spool energized by the same current.

The bobbin (A A'), Fig. 1, is disposed horizontally. The movable bobbin or solenoid (B), formed of several turns of wire, and having the form of a ring, is suspended in such a manner that its plane will be vertical and that it can turn freely around

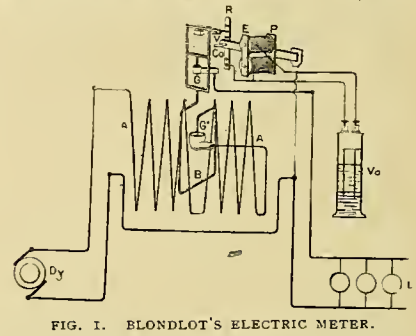


FIG. 1. BLONDLOT'S ELECTRIC METER.

its vertical diameter. Mercury cups serve to establish the connections between the movable and fixed portions of the circuit. The movable bobbin (B) assumes under the action of current a position of equilibrium in which its spirals are parallel to those of the stationary bobbin. If this is moved never so little from this vertical it will be thrown into isochronous oscillations.

Let T be the period of these oscillations and I the intensity of the current. The period T is inversely proportioned to the square root of the couple exerted by the stationary upon the movable bobbin for a known deflection of the latter. But this movement is proportional to I^2, and consequently, T is in inverse ratio to I. In other words, the product I T is a constant quantity, dependent only on the construction of the two bobbins. This product I T is simply the quantity of electricity which crosses a given section of the circuit during one oscillation. Hence, whatever the intensity of the circuit and the period of oscillation, the quantity of current which passes in the circuit during the period of one oscillation is a constant.

The value Q (in coulombs) of this constant is readily obtained by sending a known current through the aparatus and noting the corresponding duration of the oscillation.

To convert the apparatus into a meter for industrial uses it is only necessary to add to the two bobbins an arrangement which will automatically register the oscillations, each of which will tell the passage of a quantity of electricity Q, whatever may have been the intensity of the current at that time, and consequently, for obtaining the total quantity

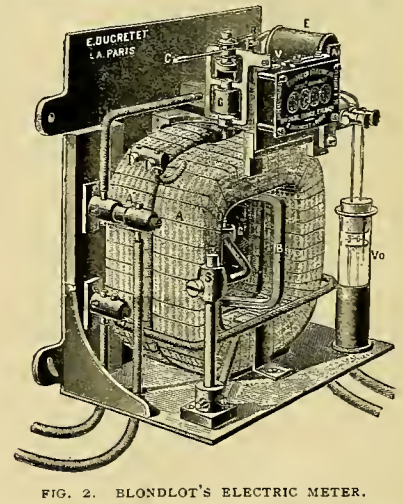


FIG. 2. BLONDLOT'S ELECTRIC METER.

of electricity passing in a given time, we simply multiply Q by the number of recorded oscillations.

To accomplish this automatic recording of the oscillations, the oscillatory movement of the vertical bobbin takes place in but one direction. Fig. 1 represents the essential parts of the apparatus. A horizontal arm is fixed to a vertical support, which in turn is solidly fixed on the bobbin (B), forming the axis of rotation. When the annular bobbin has been deflected from its equilibrium the electro-dynamic action sends it forward until the arm strikes against a spring (R, Fig. 2), formed of a metallic plate. One extremity of this spring is fastened rigidly, while the other is held against an immovable obstacle by the armature of an electromagnet (E), which holds the spring lightly while the magnet is inoperative, but immediately the arm touches the

spring (R) it closes a circuit through the electromagnet, the armature closes, freeing the spring, which gives the arm a return blow and thus renews the oscillation continuously while current flows. A ratchet movement actuated by the armature records the movements by rack-and-pinion action.

This oscillatory movement of the bobbin is entirely independent of the passive resistance of the electromagnet counter apparatus, for this is mechanical solely. The magnitude of the impulse imparted by the spring is without influence upon the duration of the oscillation.

The regulation may be varied by varying the moment of inertia of the movable coil. The apparatus is extremely sensitive to the most rapid variations of current intensity, and is applicable to alternate as well as continuous currents. This movement is accomplished by the following arrangement: Perpendicular to the axis of the movable coil is fixed an arm carrying a small mass of soft iron (C), serving as an armature to a magnet (A i) fixed to the frame of the apparatus. The attraction of the magnet, which is extremely weak and only extends but a short distance, is added to the electrodynamic action for returning the movable coil to its normal position of equilibrium. Friction is thus overcome and the restoration assured, even in the case of the weakest currents in electric lighting.

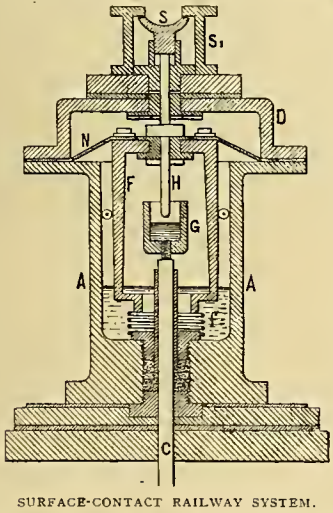
To suppress the self-induction spark a water voltmeter branches in parallel on the electromagnet coil. The regulation of this voltmeter is accomplished by varying the resistance of the liquid.

The proving of the Blondlot meter is extremely easy of accomplishment. It only requires to occasionally verify the oscillations by comparison with the standard. This figure is plainly marked on each instrument, and terrestrial magnetism has no effect on its action, which is guaranteed by the fact that there is in its composition no spring (properly so-called), no magnet, no resistance which may vary and develop a source of error in the working of the instrument.

"The meter of M. Blondlot seems to present theoretical qualities which should make it an extremely exact laboratory instrument," concludes the writer of the article in the French journal. "But for industrial use the test should be thorough and exhaustive before we can fully indorse it. If we are reserved on this point it is because that in general instruments in which action is proportional to the square of the intensity give too often but mediocre results. We shall be most happy to see it demonstrated that M. Blondlot has vanquished this difficulty."

Surface-contact Railway System.

The following brief description of a new surface-contact system for street railways is taken from l'Electricien: Referring to the illustration, (A) is a cast-iron foundation and frame, in the interior of which is a cylinder (F). This cylinder is capable of vertical movement, but is held in its normal position by the helical spring (f). A protecting ring (N) with the cover (D) serves to protect the inner portion of (A). Current is fed in via the



SURFACE-CONTACT RAILWAY SYSTEM.

cable (C), and the contact with the conductor (S) is made by the plunger (H), which is forced downward about 20 millimeters into the mercury contained in the cup (G) by the shoe which is in contact with the motor. The return is through the rail and wheel.

This system, while quite simple, can hardly be considered practicable. But it is of interest as another attempt to solve the problem.

The Tunkhannock (Pa.) Electric company, recently incorporated by Henry M. Ives and Grant Pelton of Scranton, John S. Russell of Wilkesbarre and S. W. Eysenbach and W. E. Little of Tunkhannock, has elected the following-named officers for the ensuing year: President, S. W. Eysenbach; vice-president, Henry M. Ives; secretary, Miss Eleanor J. Little; treasurer, John B. Russell, and superintendent, J. B. Nicholson of Carbondale.

Space Telegraphy in Warfare.

It is likely that space telegraphy will play a very important part in the warfare of the future on land as well as on sea. Action is said to have been recently taken by the Navy Department looking to the purchase of instruments for experimenting with wireless telegraphy on board American ships of war.

For some time past Lieutenant John Colwell, the naval attache of the United States in London, has been carefully following the Marconi experiments, and fully reporting upon them. Those reports were considered by Rear-Admiral Bradford, chief of the Bureau of Equipment, and upon his recommendation the department has instructed Lieutenant Colwell to consult with Signor Marconi regarding the purchase of instruments of the kind used in the British maneuvers and the character of their installation on board men-of-war.

The War Department has also been carrying on a series of experiments in space telegraphy and is about to put the invention into practical use. Captain Squier of the Signal Service has recently been in Europe studying the Marconi system and he has prepared a full report to General Greely, chief signal officer. Already the department feels justified in making a practical test of the system, and Captain Squier has been sent to Luzon to introduce is, it is said, in Philippine warfare. It will only be used on a small scale at first, but in all probability will be generally used when the conditions of operation in the Philippines are better understood.

It is also announced that experiments between Washington and Fort Myer will be resumed soon and that a school of instruction in space telegraphy for the men of the Signal Corps will be fitted up at Fort Myer. Members of the corps who graduate from this school will be well qualified to perform their duties. Three automobiles will be used at the school during the experiments. Two will be equipped with the Marconi wireless-telegraphy apparatus and sent to the country nearby, where tests of the system can be had free from the interruptions caused by iron and steel in buildings of the cities. The other automobile will be used for experimenting in the transportation of telegraph supplies and other materials.

Battery Cells that "Collect Electrical Energy from the Atmosphere."

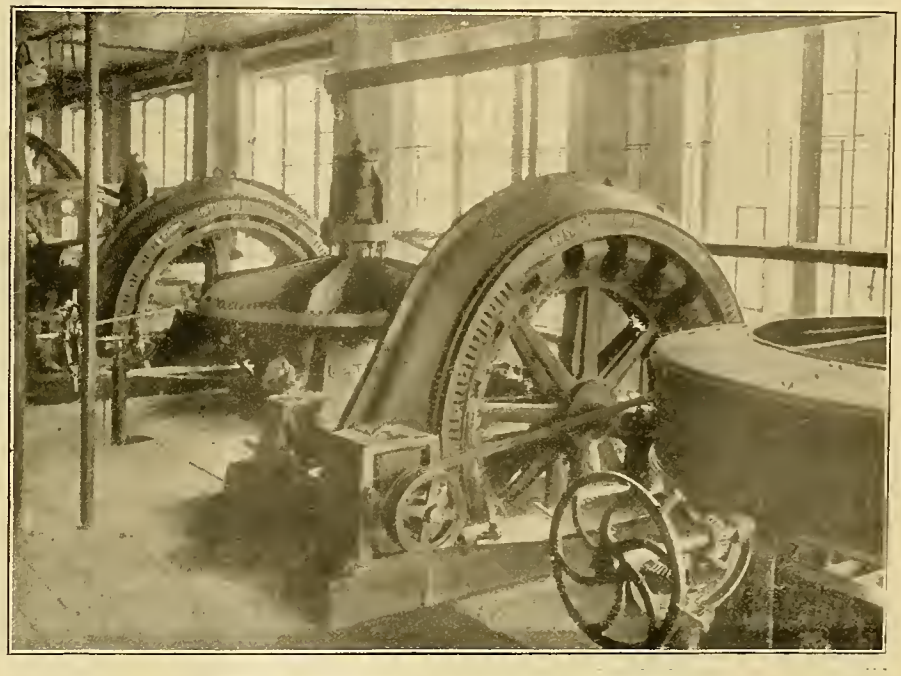
G. W. Frazier of Allegheny, Pa., thinks that he has devised a practicable scheme for collecting electrical energy from the atmosphere and storing it in accumulators. He has been experimenting for years, but has only recently, he says, perfected the battery, which he claims will be commercially successful. The earliest battery he contrived would not ring a three-ohm bell and registered an extremely light current on the galvanometer. His later experimental batteries, he claims, have shown 2½ volts to each cell. Of his work Mr. Frazier is reported to have said:

"I am convinced that my labor has been along the right lines. In addition to my small experimental batteries I have constructed two large perfected cells, which will be put to the test of hard work in a short time in a big business block in Pittsburg. The cells collect the electrical energy direct from the atmosphere, and give it up as power immediately. As the summer heat produces electricity, so does my new battery depend for its great power solely on moisture and a natural draft or pressure of hot air through the cell.

Single-phase Inductor Alternators at Schaffhausen.

The Falls of Schaffhausen, in Switzerland, form a famous cataract, 100 feet high and with a considerable volume of water. Only a very small proportion of the power available is utilized for useful work; the illustration shows a portion of the electrical generating plant of the corporation of Schaffhausen, located on the rapids, about a mile above the falls. The power house is divided into two parts by a wooden partition. One of these parts, shown in the picture, contains two single-phase inductor alternators, built by the Oerlikon company. The alternators are for the lighting of Schaffhausen, and continuous-current machines transmit power to works in the neighborhood. The turbines are of the Jonval vertical-shaft type, designed for a fall of 14 feet nine inches and a flow of 240 cubic feet of water per second. At high water, however, the fall is only 16 feet, and the flow of water must be increased to 390 cubic feet per second for the turbines to develop their rated horse power. The regulation is by hand. The turbines run at 48 revolutions per minute, and the alternators are driven through bevel gearing at 167 revolutions. Rope drive is also employed for the exciters, as seen in the illustration. The alternators generate 100 amperes at full load at a pressure of 2,000 volts and a frequency of 50 cycles per second.

The following details of the alternators are given



SINGLE-PHASE INDUCTOR ALTERNATORS AT SCHAFFHAUSEN.

in the Electrician of London, from which the picture is reproduced: Diameter of inductor wheel, eight feet nine inches. Width of air-gap, five thirty-seconds inch. The cast-iron armature frame is divided in a horizontal plane through the shaft, and vertically at right angles to the shaft, and the four parts are bolted together. The core forms two horizontal cylinders, each, of course, laminated, and the exciting coils are wound in the gap between them. Each of these two halves of the armature contains 36 coils, which are wound separately and slipped into the slotted core afterward. Each coil consists of seven turns of copper strip, 25 millimeters wide and 1.4 millimeters thick (0.985 × 0.0552 inch), and the coils of the two halves of the armature are connected in series. The armature frame can be shifted parallel to the shaft, so that the coils of either half of the armature can be got at easily. The exciting coil has 305 turns of seven-millimeter copper wire, and the exciter is a two-pole shunt machine, running at 420 revolutions per minute, and generating 120 amperes at 50 volts.

The switchboard is of the usual Oerlikon pattern, the fuses and switch contacts being behind the board. Pilot wires are brought back from three points of the secondary network in the town, and the pressure is regulated according to this by the ordinary method of varying the resistance in the shunt circuit of the exciters.

Current is distributed from about 20 transformer stations in the town, each with its own secondary network. This system is more usual in Switzerland than large sub-stations with banked transformers and one secondary network. All the high-pressure cables are underground in stoneware conduits, but some of the secondary cables are overhead. The cables are of the double lead-covered type customarily employed on the continent.

At Middletown, N. Y., on September 22d, the electric road operated by the Middletown-Goshen Traction company will be sold at auction by the receiver, William B. Royce.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.

Unless all signs fail, the fourth annual convention of the National Association of Municipal Electricians, to be held in Wilmington, Del., on Tuesday and Wednesday of next week (September 5th and 6th) will be the most successful in the history of the organization. Elaborate preparations have been made, and President Aydon, Mr. Mason and the other members of the executive committee have been untiring in their efforts to make the gathering the success it promises to be. Assurances of a large attendance have been received, not only from electricians in the eastern and middle states, but from Canada, California, Utah and other distant points as well.

It is expected that the convention will be opened by prayer offered by the bishop of Delaware, and the delegates are to be welcomed by addresses delivered by the governor of the state and the mayor of Wilmington. After a suitable response President Aydon will deliver his annual address. These exercises will be held at the Grand Opera House, where all business sessions will be held, and are scheduled to be begun at 10 a. m. on Tuesday, September 5th. Further meetings of the association will be held on Tuesday afternoon and Wednesday morning. Papers on practical subjects are to be read by Thomas Flood, commissioner of Wire Department, Boston; M. W. Mead, city electrician, Pittsburg; George F. Macdonald, superintendent of fire telegraph, Ottawa, Canada; S. D. Wheeler, superintendent of fire telegraph, Springfield; W. H. Thompson, superintendent of fire telegraph, Richmond; Captain William Brophy, chief electrician, Boston; John Weigel, superintendent of police telegraph, Boston. Discussions on the papers will be open and free, so that any member wishing special information regarding any point brought out will have an opportunity to obtain it.

The Board of Trade of the city of Wilmington has generously undertaken to entertain all those who shall be present at the convention, and has arranged an elaborate programme consisting of boat rides on the Delaware River, a visit to the fortifications recently constructed by the government at Delaware City, which were intended to protect the cities of Wilmington and Philadelphia during the late war with Spain, trolley rides, a review of the fire and police departments, a reed-bird banquet at the Clayton House, etc.

Special rates of railroad fare of one and one-third have been arranged through the Trunk Line association from all parts of the United States. All local roads leading to Wilmington have given the association a rate of one fare for both ways.

Growth of the Association.

The first meeting of the International Association of Fire and Police Telegraph Superintendents, as the organization was originally named, was called to order by Frank C. Mason of Brooklyn, N. Y., in the Clarendon Hotel, Brooklyn, Tuesday, September 15, 1896, in pursuance of a call sent out by Mr. Mason some months previous. At the meeting the following-named officers were elected: President, Frank C. Mason, Brooklyn; vice-president, Morris W. Mead, Pittsburg; secretary, L. Lemon, Baltimore; treasurer, Adam Bosch, Newark, N. J.; executive committee, John P. Barrett of Chicago, S. L. Wheeler of Springfield, Mass., J. F. Zeluff of Paterson, N. J., W. Y. Ellett of Elmira, N. Y., and W. C. Smith of New Haven, Conn. A constitution and a set of by-laws for the association were adopted. After the organization was formed a pleasant social session was held at Rockaway Beach, at which a large number of those present participated. The meeting then adjourned.

The second meeting of the association was held at Nashville, Tenn., during that state's Centennial celebration in August, 1897. At this meeting Mr. W. Y. Ellett of Elmira, N. Y., was elected president. After a pleasant and instructive two days' session the association adjourned to meet in Elmira in August, 1898.

A large number of delegates, representing many cities, presented themselves for membership at the Elmira meeting. To the personal efforts and constant activity of Mr. Ellett the association is largely indebted for its present large membership and solid financial condition.

J. W. AYDON, PRESIDENT NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.

The name International Association of Fire and Police Telegraph Superintendents was looked upon as too cumbersome and as confining the association to special lines. A meeting of the executive committee was called in Boston in February, 1899, and after due consideration and by the advice of such well-known gentlemen as Captain William Brophy of Boston, Mr. Mead of Pittsburg, Commissioner of Wires Thomas F. Flood of Boston and Mr. Mason of Brooklyn, it was decided to change the name to that of the National Association of Municipal Electricians. This move on the part of the executive committee has proven to be a wise one, as it has thrown the door open to all electrical people employed by municipalities.

During the last year the association has largely increased in membership, both active and associate, and at the present time it is represented in over 150 of the principal cities in the United States. Mr. Aydon, the present president of the association, was elected at the Elmira meeting, and has, by continual effort and an almost uninterrupted flood of communications to electrical people throughout the United States and Canada, succeeded in getting many deeply interested who were lukewarm up to the time of his administration.

The active members of the association consist of superintendents of fire and police telegraph systems of the municipalities and towns of America and other persons having charge of, or connected with, municipal electrical departments. Associate members may consist of manufacturers of and dealers in appliances relating to the interests of the association. Associate members are not entitled to vote or hold office. It is stated in the constitution that the object of the association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of fire and police telegraph, light, heat and power systems, and the diffusion of this knowledge among the members of the association, with the view of improving the service and reducing its cost; and also, according to the fundamental law of the society, the establishment and maintenance of a spirit of fraternity among the members of the association.

Officers.

The present officers of the National Association of Municipal Electricians are:

President—Jonathan W. Aydon, Wilmington, Del.

Vice-president—G. F. Macdonald, Ottawa, Ont.

Treasurer—Adam Bosch, Newark, N. J.

Secretary—H. F. Blackwell, New York city.

Financial secretary—Bert McAllister, Bradford, Pa.

Executive committee—W. Y. Ellett, Elmira, N. Y.; William Brophy, Boston, Mass.; M. W. Mead, Pittsburg, Pa.; W. H. Thompson, Richmond, Va.; F. C. Mason, Brooklyn, N. Y.

Portraits and brief biographical sketches of nearly all the officers are given:

Jonathan W. Aydon, president of the association, was born in Wilmington, Del., December 22, 1850. He has been in the employment of the Pennsylvania Railroad company for 30 years, having been appointed at the age of 19 years train dispatcher on the main line between Philadelphia and Washington. Mr. Aydon is also the superintendent of the fire and police telegraph system in Wilmington, and has filled the position for several years and brought the service to a high efficiency. Mr. Aydon is well known throughout the United States and Canada and is particularly popular with the members of the association he represents. At the annual convention of the association in Elmira last year, when he was elected president, it was through his efforts that the association adjourned to hold its next meeting at Wilmington, Del. Since that time he has devoted much time to increase the membership of the association and broaden its scope of work, and in this he has been remarkably successful.

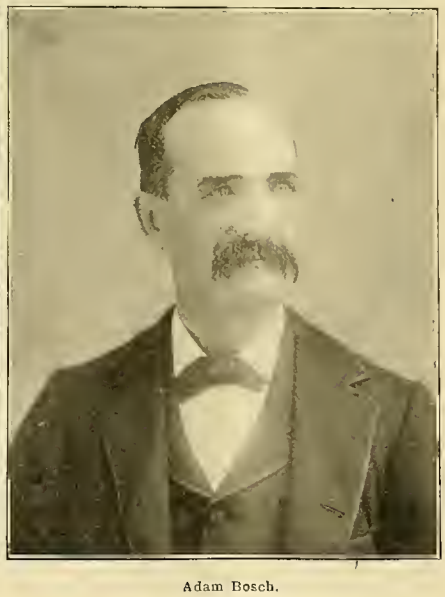
George F. Macdonald, a Canadian, fills the office of vice-president, and this fact shows the friendly international scope of the association. Mr. Macdonald is the city electrician of Ottawa, Ont., to which position he was appointed in 1874. He was born in Canada and entered the service of the Montreal Telegraph company in 1863. In 1874 he built the fire-alarm system of Ottawa, of which he has since been in charge. Mr. Macdonald is also secretary of the Fire and Lighting committee of Ottawa. He is down for a paper on the development of fire and police telegraphs in Canada, to be read at next week's meeting.

Adam Bosch is a graduate of Cooper Union, New York, having taken the five years' scientific course and receiving the Cooper Union medal. He has been for many years a member of the American Institute of Electrical Engineers and has held the position of superintendent of the Newark (N. J.) fire-alarm telegraph continuously since 1876. Mr. Bosch is treasurer of the association.

Will Y. Ellett, ex-president of the association and chairman of the executive committee, is a prominent figure in the councils of the organization. He was born in Elmira, N. Y., on July 12, 1852, and took up the study of electricity in 1879, when his native city introduced the Gamewell system of fire-alarm telegraph. Mr. Ellett was made superintendent and still holds the position. He is much interested in municipal electrical problems, which he has made a constant study, and is a popular member of the association.

William Brophy is one of the best-known electrical men in the United States, and his efforts have ever been directed toward a higher standard of electrical construction. He is distinguished by sound common-sense in his intercourse with his fellows and has done much to bring about the present understanding between the electrical and insurance interests of the country. He is an American of Irish birth, having been brought to this country at the tender age of five years. Much of Mr. Brophy's life was spent in Worcester, Mass. From 1871 to 1886 he occupied the position of superintendent of the fire-alarm telegraph of that city. About 1884 the construction of the plant of the Worcester Elec-

G. F. Macdonald.



Adam Bosch.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—VICE-PRESIDENT AND TREASURER.

tric Light company was decided upon. Electric lighting at that time was really "in its infancy," and was regarded with fear. Mr. Brophy was given charge of the construction of this plant, the mayor holding him personally responsible. He was so successful that he attracted the attention of insurance men, who had been at a loss as to the best way of handling the new electrical development. Mr. Brophy became the general inspector for the New England Insurance Exchange, which had formed an electrical committee, and by hard, intelligent work he did a great deal to reduce the hazard of electrical fires. He appeared at conventions of electrical men, of firemen and of insurance men, and was instrumental in bringing about the intelligent co-operation of the present day.

In 1890 Mr. Brophy entered the service of the Electric Mutual Insurance company, organized for the purpose of insuring electric-light and power plants and to encourage a better class of electrical construction. When that company retired from business in 1892 he became connected with the Cotton and Woolen Manufacturers' Mutual Insurance company, which, in connection with other manufacturers' mutual companies, took up the work for which the Electric Mutual Insurance company was organized. Owing to ill-health Mr. Brophy

W. H. Thompson. William Brophy. W. Y. Ellett.
M. W. Mead. Frank C. Mason.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—EXECUTIVE COMMITTEE.

was obliged to give up active work in 1894, but after a few months' rest he accepted the position of chief electrician of the Wire Department of the city of Boston, which position he now holds. The department was created by an act of the Legislature, in 1894, for the purpose of removing the overhead wires in the business portion of the city and supervising all classes of electrical construction.

Morris W. Mead, superintendent of the Bureau of Electricity in Pittsburg, was born at Underhill, Vt., October 28, 1854. He attended the public schools of Pittsburg, to which city his parents removed when he was a boy, graduating from the Pittsburg High School in 1873. In 1877 he took the position of head salesman in the establishment of J. R. & A. Murdock. After a short period he entered the city fire-alarm office as an operator, being promoted in a year's time to position of chief operator. Two years later he was appointed superintendent of the fire-alarm telegraph, in those days a comparatively small institution. During his first year of service a vacancy occurred and he was made secretary of the Fire Commission, holding for two years the combined positions of secretary of the Fire Commission and superintendent of the fire-alarm telegraph. So many electrical improvements and additions were made in the department of which he was superintendent that another secretary was elected; and Mr. Mead after that was able to give his entire time to the superintendence of the electrical system of the city. Under him was introduced the police telephone system of Department of Public Safety. In 1887 the new charter was passed in Pittsburg, establishing a bureau of electricity, and Mr. Mead was made the superintendent. This bureau combines all the electrical interests of Pittsburg, including the control of the electric railroads, safety arrangements for electrical propulsion, inspection of all electric power, heat and light wires in all the buildings of the city, etc. Mr. Mead is on the electrical committee of the International Fire Chiefs' association, is a member of the national committee for standardizing wires for electric-light wiring, a member of the Old-time Telegraphers' association and a member of the National Electric Light association. He has a wide acquaintance among electrical men.

William H. Thompson is the superintendent of the fire-alarm and police telegraph of Richmond, Va., having held the position since 1884. He was born at Lynchburg, Va., in 1858, and was educated at Baltimore. He has much natural mechanical ability and has devised many of the appliances used in his department. He keeps well up to date with electrical advancement, and his services are highly valued in Richmond. Physically, Mr. Thompson is one of the smallest men in the association, but he has plenty of energy and vivacity and is one of the popular members.

Frank C. Mason, the first president of the association, may be styled the father of the organization. He issued the invitations for the first gathering and has taken great interest in it ever since. To him, more than to any other man, is due its present success. He is very well known to electrical men all over the country. He is superintendent of the police telegraphs of Brooklyn and has been interested in electrical matters since 1872, when he started in in Utica, N. Y., with the old Atlantic and Pacific Telegraph company. He gained wide experience with various telegraph and telephone companies, until 1884, when, after passing a severe competitive examination, he was appointed superintendent of the police-telegraph department of Brooklyn. Mr. Mason is alert and progressive and has developed the service in his department until it has come to be regarded as one of the best in the country. In 1895 Mr. Mason spent several months abroad, investigating the working of the police departments of London and Paris.

Wilmington Exhibition.

An electrical exhibition has been arranged to be held during the Wilmington convention. This exhibition will open on the evening of September 4th at 7:30 p. m., and continue for the entire week, closing at 7:30 p. m. on Saturday evening. Pyle's Bicycle Academy, the largest building in the state of Delaware, has been secured for this exhibition. The list of exhibitors includes Roebling's Sons company, Standard Underground Cable company, Okonite company, Shelby Electric company, Gamewell Fire-alarm Telegraph company, Montauk Multiphase Cable company, Postal and Western Union Telegraph companies, American Telegraph and Telephone company, Safety Insulated Wire and Cable company, Day's Kerite, Rolfe Electric company, Monarch Fire Appliance company and other equally well known concerns.

Jamaica Water Power Utilized for Electric Railway.

The license for a system of electric trolley lines in Kingston, in the island of Jamaica, was granted to the West India Electric company on March 10, 1898. The company started construction on May 2d, beginning with the erection of poles to carry the trolley wires. On June 23d track-laying was commenced on the Constant Spring line. It was the original intention of the promoters to work the line by electrical power generated by steam. But it was suggested that possibly water power could be used, and engineers were assigned to inquire into the feasibility of the project. After investigation, it was decided to recommend the use of the waters of the Rio Cobre for the development of the necessary power.

The question of obtaining this power was by no means a simple one. Ordinarily a dam is built with a short head race, with the power house situated close to the dam. But in the valley of the Rio Cobre, though there is a succession of rapids, there is no place where a dam of this character could be built without raising the water to such a height as would flood cultivated land and render the highways impassible. To overcome this a scheme was evolved by which the available fall of the river was utilized without in any way interfering with private or public property.

A dam was built across the river immediately opposite the mouth of the long tunnel on the railway near Bog Walk station. It is only nine feet high, but it can, if necessary, be raised three feet higher by the placing of flash boards between steel posts built in the concrete dam for the purpose. On the left bank of the river, at the dam, a "skimming basin" has been formed, into which the waters of the river pour, entering thence into a steel conduit on their way to the power house.

This steel conduit, or pipe, forms the head race for the power house. It is 6,200 feet long, the distance of the power house from the dam. It is 10 feet in diameter at the dam and its entrance is protected by a double screen, which effectually prevents the entrance of weeds and debris with the water. It is entirely built of steel, and for the greater part of its length is embedded in rock or compact earth, well protected from the river floods. At places it is supported on concrete piers. It is believed to be the largest pipe in the world, weighing 1,742,874 pounds, and the steel plates are held together by 259,102 rivets. The pipe arrived in Jamaica in the shape of curved plates, was transferred to Bog Walk by railway and taken to the site by teams. The plates were assembled, placed in position, erected and riveted entirely by native workmen, under the supervision of Mr. Peppard, a man of experience in this line of work. The native workmen learned the work as quickly and did it as satisfactorily as any workmen he had ever handled on similar construction in any country.

The capacity of the pipe is 2,205 gallons of water a second. This flows through two pairs of twin horizontal turbine wheels, each pair being enclosed in steel casings. After passing through the wheels the water flows into the tail race through the draught tubes. The turbine wheels work on horizontal shafts at a speed of 400 revolutions a minute. These shafts are coupled direct to the electric generators. At present there are two generators, each of which is capable of developing 500 horse power. There are also two smaller water-wheels, each developing 25 horse power, which are used to drive the direct-current exciters. The generators are of the latest type, and were built by the General Electric company. These generators are three-phase alternators and develop current at about 500 volts.

The power house is built entirely of steel and concrete, with foundations carried 15 feet below the bottom of the river to a bed of solid rock. The building is only 70 feet long and 38 feet wide. The floor of the building is about eight feet above the highest recorded level of the river at the spot.

The electric power is transmitted from Bog Walk to Kingston, a distance of 32 miles, on steel poles and three copper wires. The electromotive force on the transmission wires is 14,000 volts, and at the transformer station on Orange street, Kingston, the current passes through a set of transformers, entering at the high pressure of the transmission line and leaving them at about 350 volts. The energy is then transformed to the form of direct current in rotary converters and passes to the feeder cables, and thence to the cars and motors.

It is expected that construction work will soon be begun on the new electric railway in New Jersey that is to connect Caldwell with Lake Hopatcong.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

National Association of Municipal Electricians, Wilmington, Del., September 5th and 6th.

New York State Street Railway association, Ithaca, September 12th and 13th.

Old-time Telegraphers' association and United States Military Telegraph Corps, Copley Square Hotel, Boston, September 12th to 14th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

Pennsylvania Street Railway association, Stevens House, Lancaster, Pa., October 4th and 5th.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

An attractive small central-station plant at Edwardsville, in this state, is described in this issue. It is said to be fireproof, and it is evident that it is well designed and well constructed. It is certainly a credit to a town of 4,000 inhabitants, and few villages of that size can show such a complete and well-appointed plant.

Next week's convention of the National Association of Municipal Electricians at Wilmington, Del., promises to be a very successful one. A programme judiciously combining features of instruction and entertainment has been prepared, and there is no doubt that all who attend will be benefited. The association has shown a rapid and healthy growth in the few years of its existence; and that it is of real value to its members cannot be doubted.

In decorating trolley cars with flags and bunting or other inflammable material, care should be exercised that these embellishments be disposed in such manner that sparks from the trolley, in jumping contact at crossovers and other points, will not be likely to fall among the filmy stuffs and cause a fire. Fires of this character have frequently occurred, and while they are usually subdued with little damage by prompt effort, they are always alarming to passengers and sometimes result in serious injury to the car-body. Usually it is open cars that are thus decorated, and it is not difficult to arrange the flags and bunting inside and at the sides of the car, and not on the roof. If the decoration is for a night ride, lines and designs of incandescent lamps, either in clear glass or colors, make the most effective display, at the expense, of course, of the added consumption of current.

Many electric-railway companies have still to learn that the happy-go-lucky, steal-a-switch-when-you-can plan of operating trains or cars has had its day, and that with the extension of electric railways some rational method of train dispatching, especially on long, single-track lines, must be adopted. Two accidents, due to lack of intelligent co-operation of train crews, were reported as happening on electric railways last week. One was a head-on collision in Plymouth township, near Philadelphia, and several passengers were badly hurt. The railway is a single-track road, with turnouts. The passengers of the southbound car asserted that the motorman failed to wait at the switch for the arrival of the car going north, and the accident resulted.

The other accident was near High Bridge, on the road leading from Paterson, N. J., to Little Falls. The trouble here also was caused by the motorman trying to steal a switch. Several passengers were badly shaken up and thrown over the seats. One lady sustained the fracture of two ribs. The fenders were torn off and the cars were badly damaged.

Of course, it will be said that the motorman exceeded the general instructions of the road in each case. But if the cars were operated on separate train orders, which could be easily and inexpensively delivered at telephone stations along the line, it is reasonably certain that the accidents never would have happened.

It is highly gratifying to observe that American manufacturers are becoming more familiar with the requirements of foreign markets, as a result of the valuable information extensively disseminated by the reports of our consular officers and the intelligent labors of various commercial bodies; yet there is much to be learned by the majority of those who desire to obtain a market abroad for their productions.

A new epoch has opened in the world's commerce—the seller must seek the buyer, must minister to his wants and produce what he desires. This is the inflexible law of the future of international trade. No manufacturer will hereafter find a market for his goods if he waits for the buyer to come and solicit his favor. If the American people expect to figure largely in the markets of the world, they must send men equipped in each particular branch of industry to study the conditions of consumption in every country. The commercial traveler is the most important element in the extension of our foreign trade; but to be effective, he must be a man who knows the language of the country to which he is sent, who is thoroughly familiar with the economics of the manufacture of the product he represents, and he must remain long enough to comprehend the business conditions of the people whose trade he desires to secure before his opinions can be safely accepted as correct.

The large increase in the exportation of electrical machinery, telegraph and telephone instruments and material and other electrical apparatus during the last year or so is a strong testimony to the demand for American work, and it seems that all that is needed to multiply this trade many times is an intelligent study of the conditions that obtain in the various markets of the world.

Alas, that in advancing the sacred causes of science and humanity, which assuredly the new liquid-air companies are doing in making five horse power exist where only two were before, our latter-day philanthropists should disagree! Banded together in the noble work of doing the public good—associated, we should say, in the grand undertaking of doing good to the public—it is deplorable that dissensions should arise, even among the truly benevolent. But such is the frailty of poor humanity that the case is even as hinted. The disagreement is about patents, and the statements that follow are taken from advertisements.

"No patent exists which confers upon any person or company a monopoly of the manufacture of liquid air," says one company.

"The exclusive control of the inventions of [naming the inventors] for the economical production of liquid air and the practical application of liquid air as power give this company an absolute monopoly of the best methods of using liquid air; and it will protect its rights in and under these inventions and patents to the fullest extent," stoutly asserts another.

It will be observed that these statements, while somewhat at variance, are not directly contradictory. It may be true, and probably is, that no company has a monopoly of the manufacture of liquid air; still, one company may have a monopoly of one certain method, which it considers the best. It is evidently a question of methods, and the painful fact is that each company seems to care less for the general advancement of the race by the use of liquid air than it does for the prevalence of its individual method. It is as though the whole exploitation was a mere money-making expedient—not an improvement of industrial processes, but a simple stock-selling scheme. Alack, that such things be!

An interesting feature of the National Export Exposition to be opened in Philadelphia this month is the arrangement for lighting the building and grounds. The plan is to afford an opportunity for a comparative display and study of three illuminating agents and five distinct systems of lighting. These systems are based on the use of electricity, gas and kerosene oil, and in each case the idea will be to employ the latest improvements and appliances for the production of the highest measure and best quality of light. Along the South street front, the eastern boundary and the Vintage avenue boundary of the exposition grounds, and in the open space between the Implement, Vehicle and Furniture building and the Transportation building, the incandescent naphtha system will be used. Powerful Welsbach gas lamps especially designed for outdoor illumination will light the Esplanade from the main entrance of the grounds to the Main building, the lobby of which will be illuminated by Welsbach burners. On the first floor Welsbach lights will be used, while an incandescent electric system will illuminate the second floor. The exhibition arcades will be lighted by electric arc lamps. In the great auditorium, which will be lighted by incandescent electric lamps, late designs in fixtures and chandeliers will be shown. The Kitson light will illuminate the entire central pavilion; the south pavilion will be lighted by Welsbach burners, and the immense main exposition hall by both arc and incandescent electric lamps.

While a mixed lighting scheme of this character must detract from any artistic or decorative effect of the illumination as a whole, its utility for exhibition purposes is at once apparent, and the actual effect of the comparison will be awaited with interest.

Nature and Cause of Coherer Phenomena.

In a note presented to the Academy of Sciences, according to l'Electricien, M. Tommasina says that systematically conducted experiments having for their end the elucidation of the phenomena of the conductability changes in metallic dusts and in general of powders of all conducting bodies under the action of currents induced by electrical waves permit him to establish the following conclusions:

1. The augmentation of the electrical conductivity of metallic dusts is in consequence of the formation of chains rendered conductors by the contacts between particle and particle.

2. The formation of these chains results from the orientation of the particles following the lines of force of the electric field formed by the difference of potential between the two electrodes.

3. The adherence of the particles is a result of the heating of the minute contacts produced by the passage of a series of very minute sparks.

These conclusions may reasonably be deduced from the author's preceding notes, he thinks, but he has even more solid foundation, based on more recent evidence, which he proceeds to mention.

"Instantaneous Formation of Vertical Chains without Previous Contact between the Electrodes and the Filings.—These little chains, which I will speak of as of auto-formation, are less readily produced in the air than in dielectric liquids. In the air it is necessary to prevent heavy disruptive discharges, from the apparatus with which I experimented, to the induced current of a large Rhumkorff coil capable of giving sparks 35 centimeters in length. The resistance used consisted of a horizontal wooden shelf, upon which I placed the filings, the electrodes being some distance asunder. Now operating the coil by hand, at each discharge the chain formed immediately and stretched to the electrode nearest it.

"In distilled water I have succeeded in producing these 'chainettes' more than 0.20 of a meter in length, when allowing the interrupter to act on the coil. In this case the formation is not instantaneous, but the chain was less than a second in making contact with the upper electrode. If I diminished the current and permitted the electrodes to remain at the same distance, I could see a number of chainettes rise vertically, as of one accord, and strive by rapid jerks to reach the electrode. Now, gradually increasing the current, one of these chains would eventually reach the electrode and adhere to it. The immediate effect of this is to cause all the rest of the chains to fall in fragments, and to quiet all movement in the particles. The perfect chain, now a conductor, is not readily broken as long as the current is permitted to flow, but upon disconnecting the circuit, a light shock suffices to destroy the chain.

"Having placed a small quantity of metallic dust in the bottom of a V-shaped glass tube filled with distilled water, and separated the electrode terminals 0.15 of a meter, in the two branches of the tube, I observed the same phenomena, but doubled; that is, the chains were formed in each branch. The electrodes being raised from the water so that the sparks were visible at the surface, the chainettes were formed as before, and each stretched to nearly the point where the sparks entered the water.

"In the dark one may see little sparks in line, forming true luminous chains, of which the length depends on the current intensity. At the summit of these chainettes a sort of escaping brush light may be seen which produces a lively movement in the dust, but when the chain finally makes contact with the electrodes all movement and all sparking cease.

"Phantoms or Specters of Electric Lines of Force by Chains of Filings in Distilled Water.—The production of chains between two disruptive discharges induced me to believe that I might cause the metallic powders to show the lines of force. In a large, flat recipient I placed a layer of silver filings, which I covered with three or four millimeters only of distilled water. Two aluminum wires, enclosed in glass tubes, were placed obliquely, and separated at their upper extremities to prevent short-circuit escape, while the terminals in the water were bent in such a manner as to stand vertically in the water, while touching the bottom of the dish.

"With a current less intense than that used in the preceding experiments, I saw little chains form suddenly, radiating from the two aluminum electrodes, and form precisely similar curves to those formed by iron filings between magnetic poles. But as soon as the slightest perfect metallic connection was formed between the electrodes the movement ceased, and I was obliged, in order to get a perfect representation of the lines of force, to break the chain frequently, when the formation was immediately renewed. By aspirating the water as far as possible and evaporating the rest, I was able to preserve the electric phantom thus obtained.

"During this experiment, performed in the dark, after increasing the current and jarring of the vessel, minute sparks indicated the lines of force.

"These experiments are conclusive to me that the phenomena seen in the much more limited field of the coherer are identical with what is shown here."

The Electrical Trade of the West.

In a recent interview Mr. Ellicott, the city electrician of Chicago, told a reporter of the gratifying volume of electrical business in the West. "The General Electric company is about seven months behind in its filling of orders," said he. "The Western Electric company is between 10 months and a year behind. Both concerns are crowded with orders, and have all that they can do to keep up with the procession, and the same may be said of other manufacturing companies. So great is the demand for copper wire that it will not be delivered in over 10-mile lots at the present time. The city has been after 400 miles of wire for some time past, and so far has only been able to secure 150 miles of the quantity needed.

"The home electrical trade of Chicago is enormous, and is being augmented to an extraordinary degree by the demands from the country. Where at one time New York was called on for electrical supplies, the demand is now made upon Chicago. There is very little of the western business that gets by this city. How long this extraordinary activity will continue it is hard to say, but I imagine that by next year things will get down to a normal level. When the new business started in nearly all of the supply companies found their manufacturing facilities too small for the demand. Additions have been made, and are being made, and by 1900 will be up to the needs of the trade. There will be no tendency then to overdo business. Prices in all kinds of electrical supplies are stiff and likely to remain so for some time."

Electric-railway Plans of the Pennsylvania Company.

The passenger and freight traffic on the Pennsylvania railroad has increased to such an extent that the carrying capacity of the road is taxed to the utmost. To relieve this heavy traffic, and perhaps to do away entirely with some of the suburban trains, the company has decided to build and control electric-railway systems in some of the more densely populated districts of New Jersey and Pennsylvania. Already negotiations are pending which will unite all the trolley lines in the northern and eastern section of New Jersey, and the capitalists who are negotiating this deal are said to be planning for a 33-mile road in Pennsylvania from Philadelphia to Sonth Trenton. As the electric lines can be operated at less expense than the steam roads, cheaper fares will be charged, and it is expected that the bulk of the local traffic will be diverted from the steam routes. Facilities for the transportation of freight will be added as the business increases. When the plan is carried into execution fewer local or short trains will be run on the steam roads, but more through express trains will be added to accommodate the increasing demands of through passenger traffic. The company has already in successful operation several electric lines and is said to be securing franchises and rights-of-way to parallel its route from Philadelphia to Washington with a trolley line.

American Association for the Advancement of Science.

The forty-eighth meeting of the American Association for the Advancement of Science was held in Columbus, O., last week. Several affiliated societies also held their meetings at the same time or previous to the meeting of the association, which extended from August 21st to 25th. Professor F. W. Putnam of Cambridge, the retiring president, called the meeting to order and introduced the president-elect, Professor Edward Orton of Columbus. The scientists were welcomed by representatives of the governor, of the city and of the Ohio State University, which is located at Columbus, and on whose grounds the meetings were held. A number of very interesting and instructive papers were read, among which were several of an electrical character, delivered in the sections of physics and engineering. A notable paper was by R. A. Fessenden, on the nature of electricity and magnetism and a determination of the tensity and elasticity of the ether, presenting several conclusions which are new to physicists and are regarded as an advance toward the solution of some abstruse problems. The next meeting of the association will be held in New York, June 25-30, 1900.

Aeronant Alights on a Trolley Car.

John Loomis, an aeronant, made a balloon ascension from Sans Souci Park on the South Side of Chicago, on August 27th, and after shooting upward to a height of about 2,000 feet, dropped in a parachute. In endeavoring to avoid a housetop as a landing place, he came directly down upon the top of a crowded trolley car on Sixty-first street, between Wabash and Michigan avenues. His parachute fell over the open side of the car and entangled half a dozen passengers who had leaped from their seats, and a panic ensued, the ropes being mistaken for broken trolley wires. One lady was injured, though not seriously. Loomis struck the right side of his face against the trolley wire and received a painful burn. He said afterward that in 10 years he had made 250 ascensions, but never found one as exciting as this.

Bids for Chicago Drainage Canal Power.

The trustees of the Chicago drainage canal at a recent meeting received and referred to the engineering committee two bids for the development of the water power which will be created at Lockport and Joliet by the completion of the canal. One of the bids was from Clarence Buckingham, one of the directors of the Chicago Union Traction company, and the other from the Economy Heat and Power company of Joliet, of which John Norton is president. The Norton bid was $4 a horse power a year for a 75 or 99-year franchise, while that of Mr. Buckingham was $5 a horse power a year for a 50-year franchise. It is estimated that the water power developed will be 20,000 horse power, which would make the total annual payments at the terms of the bids $80,000 and $100,000 respectively. The Norton company also agreed to furnish power for electric lighting to the city of Chicago at Robey street at $25 a horse power per annum.

At the same time the trustees adopted a resolution instructing the engineering committee to put into any contract which may be drawn a clause allowing the trustees, or the city of Chicago, under their authority, to take over at the end of any period of 10 years in the life of the contract any plant which may be erected for the development of the power, on the payment of proper compensation. It was taken for granted in the debate over this resolution that its passage would mean the practical rejection of any or all bids so far received.

Scott-Janney Electric Company.

The stockholders of the new Scott-Janney Electric company held a meeting at Philadelphia recently and elected the following-named gentlemen as directors: Robert Alexander, Philadelphia; William B. Hill, New York; Edward A. Abbott, Concord, N. H.; J. F. Tapley, New York; Frank LeBar, Providence Life and Trust company, Philadelphia; Henry A. Sage, Ogdensburg, N. Y.; Gordon J. Scott, Philadelphia; General Frank Reeder, Easton, Pa.; J. B. Dill, New York; W. W. Wolverton, treasurer of the Bell Telephone company, New York; Charles W. Drake, former vice-president of the Missouri Pacific Railway company, New York; Allen D. Loney, New York; T. Quincy Brown, president of the Atlantic National Bank of Boston; Daniel O'Day, Charles Watson, C. W. Ogden of New York; Frank R. Hansell, George H. B. Martin, New Jersey; William S. Janney, R. F. Loper and Charles W. Walter of Philadelphia. The Scott-Janney company was recently incorporated at Trenton, N. J., with a capital of $30,000,000, and is said to have been organized to compete with the General Electric company and the Westinghouse Electric and Manufacturing company. It is stated that a large plant will be built in Philadelphia at once.

BOOK NOTES.

D. C. Jackson, professor of electrical engineering in the University of Wisconsin, and J. P. Jackson, professor of electrical engineering in the State College, Pennsylvania, are the authors of a book on "Elementary Electricity and Magnetism," intended as a manual for artisans and apprentices and as a textbook for manual-training schools and high schools. The volume is about to be published by the Macmillan company of New York. It is said that the book will deal with the subject in a less didactic manner than usual, but will contain a very large number of numerical examples, which are worked out in the text, and also many problems for the reader to work out.

Readers of the Western Electrician will be much interested in the announcement of the Macmillan company of New York that Mr. B. J. Arnold's work on "Design and Construction of Electric Power Plants" will be published this fall. Eleven lectures delivered before the Department of Electrical and Steam Engineering of the University of Nebraska in March, 1897, are the original groundwork on which this book is built. Mr. Arnold was formerly a student at Lincoln, and his course of lectures was highly appreciated by the faculty, undergraduates and visiting engineers. By courtesy of the author an arrangement was made to publish in the Western Electrician a series of articles based on these lectures, which were somewhat abridged and adapted for publication as the work progressed. These articles ran in this journal from April 3 to August 14, 1897, appearing in a number of installments and enriched with 78 illustrations. Their value, due to Mr. Arnold's ability, thoroughness and skill, both as a student and as an engineer, was immediately recognized, and the demand for the numbers containing the articles was such that some of the earlier ones were out of print before the series was completed. Taken together, the articles gave a clear and comprehensive view of the whole subject of electric power-station design, one admirable feature being the fairness with which differing theories developed in modern practice were set forth. Now the whole mass of material has been recast, amended, brought down to date, and is about to be published in book form. It is safe to say that from the electrical engineer's point of view this will be one of the most important books of the year.

DEVELOPMENT OF THE TELEPHONE FIELD.

Privacy of Telephone Communications.

By H. P. Clausen.

Part I.

Designers of telephone appliances often receive peculiar requests for information from superintendents, electricians and others employed by the opposition telephone companies. As a rule, however, the requests for information, sometimes unreasonable, are made by the business managers of operating companies, and in order to obtain their goodwill (and incidentally the patronage), the designer is obliged to give some answer to every inquiry, no

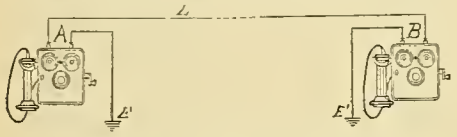


FIG 1. PRIVACY OF TELEPHONE COMMUNICATIONS.

matter how absurd or impossible of solution the problem may appear.

A fruitful source of inquiries, which, at first thought, might appear to belong to the unreasonable class, relates to the methods for detecting and circumventing the baneful operations of the telephone eavesdropper. Believing that a general discussion of the methods employed by eavesdroppers and means for detecting their presence "on a wire" may be of interest, if not even of some value, to his readers, the writer has prepared a series of articles on the subject. The series will be illustrated by simple though entirely practicable diagrams, that may be read at a glance, even by the most inexperienced telephonist.

Referring to Fig. 1, we have before us the well-known earth-return telephone circuit, comprising the subscribers' equipment (A) and (B), the line wire (L) and earth circuit from (E) to (E'). The operation of this system requires no further consideration other than to say that whenever an operator at (A) desires to speak to an operator at (B), B's attention is called to the fact by A's performing some act which will result in sounding an alarm at the (B) telephone station, and, vice versa, (B) may call (A) whenever the occasion arises. After gaining the required operator's attention, the telephone users may proceed to transact their business.

Now, then, referring to Fig. 2, it will be observed that the formerly simple telephone circuit (Fig. 1) has been somewhat complicated by the addition of a third instrument connected to the line wire (L) at (C). In other words, another telephone station has been established, and any communication passing between the (A) and (B) subscribers will be heard by the secret listener, located at (C).

It might be argued that any unauthorized tapping of the main line would not long remain undiscovered, and that a systematic inspection of the line would effectually prevent any branch circuit from remaining undisturbed beyond the periods of such inspections. However true this may be with the clumsy operations of a novice, it is not applicable to the mechanisms of an expert, who expects to reap a rich harvest by learning all that passes over the wire between the above stations. Take, for example, the cutting in of an intermediate station, as shown by Fig. 2, it is hardly imaginable that any prospective eavesdropper other than the most clumsy novice would think of tapping the line wire in such a manner as to reveal the point at which the branch line was attached. As a rule, the connection is made by a wire of a small diameter. If the main line passes through trees, the latter offer a good support from which the branch line can be connected to the main. On the other hand, the branch wire may be buried in a trench, then pass up the side of a pole, and connect to the line wire near

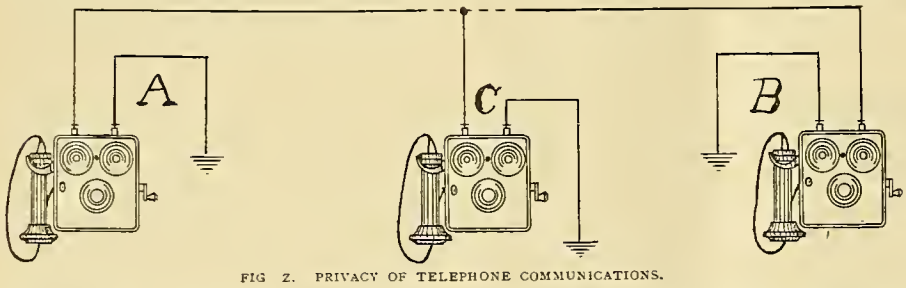


FIG 2. PRIVACY OF TELEPHONE COMMUNICATIONS.

the insulator. This method of tapping in is very hard to locate, and cannot be discovered without a close examination of every support in the circuit.

An instance of line tapping which, for the ingenuity displayed, deserves mention came to the writer's notice several years ago. Important messages sent over a private telephone line, eight miles in length, appeared to gain publicity in a remarkably mysterious manner. The line, an earth return, was not paralleled by other telephone circuits within five miles of either side, so the question of induction did not receive any consideration. The line did not pass through trees or near large structures, which might have served as a support for the tap wire. A pole-to-pole inspection of every insulator support of the line was made without the slightest indication of a permanent tap being discovered. These inspections were repeated with the same result. This left no other theory, aside from the assumption that a temporary tap was being made by someone from the roadside. This theory was accepted as final when an electrician found that the line tested open when sending generator current out over the line, while the other terminal instrument was left disconnected.

About this time the writer's attention was drawn to the case, and at his suggestion, both ends of the circuit were arranged with an ordinary 20-ohm detecting galvanometer and five cells of dry battery. As shown by Fig. 3, the telephones, galvanometers and batteries were connected in series. Normally, however, and with a clear line, the galvanometers should remain in a neutral position by reason of the batteries (B) and (B') being opposed to each other's electromotive force (like poles to earth). After the connections that are shown had been made, it was found that the galvanometer indicating needle assumed an almost imperceptible leaning position toward the right. This indicated a slight ground on the line somewhere between the end stations, which, of course, allowed the (B) and (B') batteries to act upon the (G) and (G') galvanometers. This condition continued unchanged for several days after, until one evening, during a conversation, both speakers were surprised to see the galvanometer indicating needle exhibit a remarkable degree of activity, swinging to and fro, and and finally settling down to a leaning position, far to the right of its normal position. This was just the signal that had been looked for, and, in obedience to instructions, the conversation was concluded. Some minutes after the receivers had been

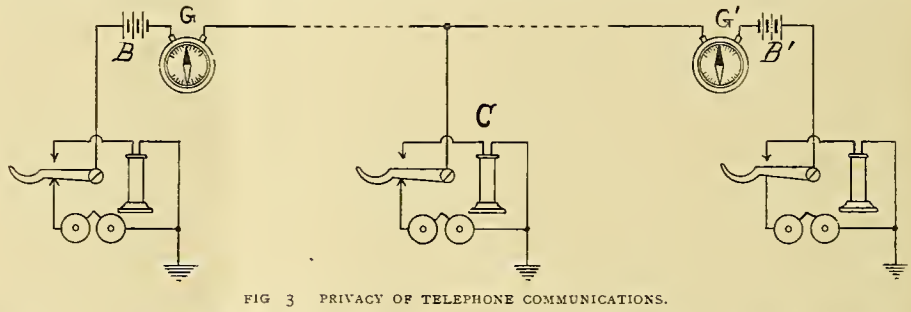


FIG 3 PRIVACY OF TELEPHONE COMMUNICATIONS.

replaced on their supports, the galvanometer needle repeated its former gyrations, and ultimately settled down to the originally slightly leaning state. After a short time, however, the needle again became restless, but only for a few seconds, immediately settling back to normal. This phenomenon was repeated several times, and in order to ascertain whether the ground (for a ground it must be) was due to accidental causes, a conversation was started, during which the needle, after a few swings, was observed to assume its tell-tale leaning position. Thus it was established beyond a doubt that there was an eavesdropper, and, furthermore, that his station equipment consisted simply of a speech-receiving equipment. This probably was a fact, for had the station been equipped with a signal receiver, the intermittent "cutting in," as was shown by the galvanometer, would have been unnecessary.

Inasmuch, however, as the eavesdropper's identity and his instruments were never discovered, it only interests us to learn how the line was tapped. Observing that the deflections of the galvanometer needles were about equal in degree at both terminal stations, all poles between the third and fifth mile were subjected to a most rigorous examination. tion, but even then it was only by the merest accident that the tap was discovered, and that at a pole which already had passed muster and been pronounced clear. On leaving this particular pole the inspector happened to kick away some earth around the bottom and discovered that the lightning-guard wire was attached near the ground to a piece of rubber-covered wire buried in the earth. The other end of this wire was found to terminate near the fence along the roadside, and connected to the lower barbed wire, and that is as far as it ever was traced. It remained to discover how the lightning-guard wire was connected to the telephone line. After loosening the tie-wire the line swung clear, but the tie-wire stuck fast to the insulator (which was mounted on a side bracket), and then the mystery was as clear as day. The pony glass insulator had a hole bored through from the groove downward and into its inner surface. A piece of broom wire, wrapped around the tie-wire, passed through the insulator, then through a hole in the bracket and through an almost imperceptible hole in the pole to a point under the lightning-guard wire. A staple driven over the joint completed the connection, and it certainly made a pretty piece of work, the ingenuity of which was deserving of a better cause.

Central Union Subscribers Rebel in Rock Island.

To say that the citizens of Rock Island and Moline, Ill., are thoroughly disgusted with the service of the Central Union company seems to be putting it mildly. For some time an agitation for better telephone service has been in progress, and very recently a committee of the Rock Island Club—an organization of business men—made a report on the subject. Here are some extracts from that report:

The telephone service that has been furnished in the past has been so inefficient and wretched that equity would demand that a rebate of one-half or one quarter rentals should be claimed by all subscribers of last and present quarter.

We believe that a greater portion of the troubles experienced in the past are directly traceable to the apparent desire of the board of directors, which we believe is influenced in turn by the extortionate demands of the Bell Telephone company, the parent company. Their policy, we believe, is to encourage strife between the various managers, not in furnishing the best service, but in making the greatest returns in rentals at the lowest possible cost. To this policy is attributable the practice of cutting down the wages of the overworked, overstrained girls in this office to five cents per hour and working them nine and one-half hours. Such wages are grossly inadequate.

Your committee is not disposed to be quieted by empty promises. The universal experience of the public with the company in the past is such that it would be vain to expect any equitable adjustment for the past bad service, any reasonable rate for the future, or any compensation for the employes above the lowest figures that the most inefficient help can be obtained for. Your committee has no reason to expect any change in the company's policy. There is but one way, in your committee's opinion, to obtain relief, and that is in the formation of another company and the unanimous support thereof by the subscribers.

To obtain this relief your committee would advise the calling of a subscribers' meeting, and an invitation to the business associations of Davenport and Moline to act in harmony with the club in calling similar meetings. In the latter city, we feel satisfied, the sentiment against the present company is as strong as it is here, for its City Council has passed denunciatory resolutions.

Your committee is advised that a better service can be furnished for $30 and $18 a year with a liberal margin of profit than we are now receiving. All that we are paying above that rate is tribute levied to enable the local company and its parent, the Bell company, to crush people suffering similar grievances who have the independence to shake off the yoke.

Long-distance Lines Radiating from Salt Lake City.

The Salt Lake (Utah) Tribune says that early in September the Rocky Mountain Bell Telephone company expects to have a line operating from Salt Lake to the coast. Two more wires are being strung between Salt Lake and Ogden. The line to Dillon, Mont., will be completed soon and thus connection will be made with the line from the coast now being operated to Dillon.

The same company has decided to rebuild the telephone line from Cheyenne to Laramie, Wyo., a distance of 50 miles, and will put in a copper circuit. The cost of the line will be nearly $10,000. It is believed that it is a link in a long-distance line from Salt Lake to Denver and the East.

Minneapolis Druggists Dissatisfied.

The Northwestern Telephone Exchange company in Minneapolis has instructed its operators in answering calls from drug stores to ask the caller if he is the subscriber for the telephone, and if he replies in the negative, the connection will be refused. The company claims that the amount of trivial conversation by "deadheads" is seriously interfering with the legitimate telephone traffic, and takes this means of correcting it. But it angers the druggists very much, and more than one of them declare that the minute the Mississippi Valley company gets its exchange in, the Northwestern company can take its instruments out entirely; they want nothing more to do with the old company.

The Syracuse (N. Y.) Telephone company is laying subways through East Washington street to Bank alley and down Bank alley to the rear of the Snow building, to connect with headquarters. The company, it is claimed, now has 1,800 subscribers.

National Telephone Company of England.

The annual meeting of the National Telephone company of England was held in London last month. This company corresponds, on a smaller scale, to the American Bell on this side of the water, and is no more popular. It is proposed that the British government operate the telephone service as a public monopoly, and terms of payment for the absorption of the National plant have been discussed. The plans of the company and its relation to the government are therefore of particular interest.

The president stated that the year to June 30th had been a record year, and they had had the largest accession of subscribers that they had ever had in any previous year. Out of the available balance of £178,963 they recommended the payment of a dividend at the rate of six per cent. per annum, less income tax, on the first and second preference shares; of five per cent, per annum, less income tax, on the third preference shares, and of six per cent. per annum, free of income tax, on the ordinary shares. They were constantly incurring expenditure on capital account, and this was a process which must go on, as the business could not otherwise increase. If the business was to go on at anything like the same ratio as it had done in the past half year—during which they had spent on capital account over £372,329 in the erection of 10,479 additional exchange and private lines, and in the construction of underground lines—they must have more capital. The system was undergoing a gradual change, owing to new developments, but the great and vital change which had been made was in getting out of the air into the earth. In the last two years the company had expended a very large sum, indeed, in removing the wires in the air into pipes in the earth in all the large centers—such as Liverpool, Manchester and Birmingham. It was estimated that at the present moment the company had about £750,000 unproductive in the earth.

A proposition to increase the capital stock of the company by £2,000,000 was submitted to the stockholders and passed by a unanimous vote.

Alluding to the need of this money and the relations of the company to the government, the president said in substance:

The company could not go on expanding as it was doing without having capital powers behind it, unless it was going to stop. He did not, however, think that it would stop. No doubt some alarm had been felt in the past few months by those interested in the company as to what might arise, as a new policy had had to be faced by the company. The wise thing in this world was to get all one could if one could not get all one wanted, and it was certain that in connection with recent matters the directors had got all they could, although they had certainly not got all they had wanted. On behalf of the company they had come to an agreement with the government. It must be remembered that after all the company was only the delegate—the licensee—of the state, and the state was absolute master with people in the company's position. Wisely or unwisely, the state said that it wanted the telephone to be worked in a peculiar way. Therefore, what was the management to do? What did wise people do? They accepted the inevitable. The directors had made up their minds, after much deliberation, and after undergoing great anxiety in the protection of the company's interests, to accept the policy of the government, and it would be idle to go back and say that they thought that they could have devised something wiser. Persons must adapt themselves to the views of those who controlled them. The government thought that the telephone system was to be popularized, and they had strong views on this matter. The government was going to popularize it by spending a large sum of money to compete with the company. The company had to face the competition, and they were bound—and recognized their duty—to act loyally in assisting in the achievement of the object in view. How far it would succeed or not time would show. They must not, however, be behindhand in the effort, not only to secure their own position, being in possession of eight-tenths or nine-tenths of the centers of the business, but they must expand, and honestly and in good faith see what they could do to assist the government in popularizing the telephone. He had no doubt that the company would be able to maintain its position, particularly if the chance were given to it of improving its service by being afforded those facilities as to wayleaves, etc., without which it was impossible to have a perfect service. They would have to stand the shock of competition, but if this only meant that it would have to do a good deal more work, and at a less sum per message on the average; in other words, if its average profits kept up and its work only increased, the shareholders would not be much worse off. He only stated the bare truth when he said that had it not been for the efforts of his colleagues on the board the company would have come out of the recent discussions much worse than was now likely to be the case. He was sure that the shareholders would commend the course which the directors had determined to take, which simply was to co-operate loyally in furthering those views which they knew that the government held strongly about popularizing the telephone. In his speech last March in the House of Commons Mr. Hanbury said a good many things which were at the moment unpalatable to the company and to himself, but the right honorable gentleman made one short statement which disarmed his own (the speaker's) injured feelings. That statement was as follows: "The government is naturally most anxious to be perfectly fair to the National Telephone company. It would be mere folly not to recognize fully—and most unjust not to recognize fully—the work that the company has done to develop telephonic communication in this country. We want to be fair to the company, but our fairness must rest upon established facts." That statement excused a good many inaccuracies, as to which he would only say that Mr. Hanbury had been greatly misled by the information which had been given to him regarding the company in comparison with other telephone companies elsewhere. Stockholm was the one great comparison that was made with this company, but with regard to the telephone there, the late postmaster-general, Mr. Arnold Morley—who was the author really of the agreement with this company as it now stood—said before the parliamentary committee in 1898: "The result of inquiries made by me in Stockholm of the postmaster-general there, and the chairman of one of the companies, was that it was being carried on at a ruinous loss both to the government and to the company." Continuing, the president remarked that this was what their company had been having rammed down its throat—that it was to resort to the methods of working the telephone in Stockholm, in order that it might conduct its business, at a ruinous loss to itself, for the benefit of those who could well afford to pay for the service.

The Situation in Concord.

[From a correspondent of the Western Electrician.]

Concord, N. H., August 24.—New Hampshire has had its first telephone fight. About a year ago the New England Automatic Telephone company, chartered under the laws of the state of Maine and owning rights of an old local company, applied for permision to lay wires in the city, making very liberal offers for official telephones and about 50 per cent. reduction in regular rates to subscribers, compared with prices of the Bell company. The new company also made the first proposition to bury the wires. Many hearings were held, and the Bell people employed the best lawyers to insist that the new company put up a guarantee, which was raised to $25,000 in cash and $5,000 bonds, notwithstanding the fact that the Bell company had never made a deposit for like privileges. The new company, disliking to be mulcted by the city at the behest of a rival company (which has been as outrageously dictatorial here as in any city of the country), will lie low for the present and wait till the people who have subscribed for its system shall assert their rights.

At the last meeting of the city government a proposition of the Bell company to bury its wires in certain streets was accepted, and work will soon be commenced. The Bell people claim great credit for liberality in so doing, notwithstanding the fact that the new company first offered to bury its wires and Mayor Martin's inaugural recommended an ordinance requiring the work to be done. C.

EXTENSIONS AND IMPROVEMENTS.

The New Home Telephone company of Rochester, N. Y., has contracted for Stromberg-Carlson telephones and switchboards and cable of the Standard Underground Cable company's make.

A dispatch from Knoxville, Tenn., states that the People's Telephone and Telegraph company of that city, one of the largest independent telephone companies in the South, has again begun extending its lines into the territory covered by the East Tennessee Telephone company, which operates under the Bell patents. Lines are being built eastward to connect with the independent companies at Bristol and southward to Chattanooga and intermediate points, by October 1st. The company expects to have connection with Dalton, Ga., and later will extend to Atlanta, while eastern connection will be made at Bristol with the large eastern cities.

MANUFACTURERS AND DEALERS.

The Western Electrical Supply company of St. Louis reports that it has closed recently several large telephone contracts. It has met with much success with its new 1900 telephone. This telephone is said to embody all the newest and most up-to-date ideas in the telephone line. The telephone department of this company has been greatly enlarged, and it is now carrying one of the largest stocks of telephones in the West. The company is always glad to send its instruments on trial, with the privilege of returning them should they not be everything claimed for them. The company has a number of circulars, etc., on new things in the telephone line which it will mail on application.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Albert Lea (Minn.) Telephone company will install an exchange at Alden, Minn.

The council of St. Paul is developing a hostile spirit against the Northwestern Telephone Exchange company. The company is operating without a franchise in that city, and an inquiry to the corporation attorney brings an opinion that the company has rights on but a few of the streets of the city. On the rest it is a trespasser. The committee on streets proposes to have the poles removed, even if it is necessary to chop down the offending poles. The council is inclined to force the company to accept the same franchise that the Mississippi Valley company has and pay a revenue to the city for the use of the streets.

The higher rates proposed by the Wisconsin Telephone company at Chippewa Falls, Wis., have resulted in the business men there opening negotiations with a Minneapolis capitalist to assist in putting in a home telephone system. Already two parties are on the ground seeking franchises.

The Monroe Telephone company of Monroe, Wis., expects to be ready for business by September 15th.

The American Telephone and Telegraph company has completed long-distance connection with St. Paul, giving the Saintly City connection with all the wires of the company all over the United States.

Telephone connection has been completed between Slayton and Currie, Minn.

Telephone connection between Wheaton, Minn., and White Rock, S. D., has been made.

The Marshfield (Wis.) Telephone company has an increase of 40 per cent. in subscribers during the past year. The plant has earned of late about $190 a month.

P. J. Skolsky of Milwaukee has been appointed division superintendent for the Wisconsin Telephone company, with headquarters at Eau Claire, Wis.

The Mississippi Valley Telephone company is working hard in Minneapolis to get its exchange in operation as soon as possible and take advantage of the present feeling against the Northwestern company. The former expects to have 1,200 connections in working order by September 10th. Of this number it is said that all but 10 are now subscribers of the Northwestern.

The Northeastern Minnesota Telephone company is preparing to put in an exchange for Princeton, Minn.

A recent storm at Duluth, Minn., disabled about four-fifths of the telephones in the city.

An effort was made at Lakota, N. D., recently to interest the business men in a telephone exchange, but without success.

The Brodhead (Wis.) Telephone company has been formed and will proceed to install an exchange at once.

A local telephone system is projected for Jordan, Minn.

The Duluth (Minn.) Telephone company complains of a lack of men to make repairs to its system and to construct the toll line to Ashland, Wis.

The Winona (Minn.) Telephone company will move its central offices to larger quarters. The Bell company announces that it will put its wires in the business part of Winona underground, at a cost of $100,000.

The Odebolt Telephone company is an applicant for a franchise at Ida Grove, Ia.

The Iowa Telephone company is defendant for two suits for damages, one for $10,000 and one for $2,000, for an accident at Riverside, Ia. C. J. Holtz was driving a wagon there, loaded with ties. In turning a corner the wagon struck a telephone pole and the ties were thrown forward, crushing young Holtz. The claim is made that the company had no franchise in Riverside, and the pole was set directly in the road. The mother of Holtz sues for $10,000 as administratrix of his estate.

The Mutual Telephone company has been incorporated at Burlington, Ia., with $25,000 capital stock.

Former stockholders of the Ottumwa (Ia.) Long-distance Telephone company have filed a suit in equity, charging the recent sale to be fraudulent, and asking that it be set aside and a receiver appointed.

The Belle Plaine (Ia.) Telephone company has filed articles of incorporation.

The telephone system at St. Ansgar, Ia., will be extended to Carpenter and other points.

The Mount Vernon (Ia.) Telephone company has been incorporated with $10,000 capital stock.

The Rocky Mountain Bell Telephone company expects to have connection between Montana cities and Salt Lake, Utah, by September 1st.

John G. McBride has secured a verdict of $1 damages against the Sunset Telephone company at Spokane, Wash., for mental anguish for the neglect to deliver a message notifying him of the serious illness of his daughter and a request for funds. He claimed that the failure to send the money caused an estrangement with his family, which still exists, and asked $25,000 damages. The court held he had a cause for action, but only for mental anguish, for which only nominal damages could be given.

Potter's Foam Preventer.

To prevent the foaming of boilers the Potter apparatus is recommended as simple, ingenious and practical. The device is shown in the accompanying cut (Fig. 1). Fig. 2 illustrates the application to the drum of a Babcock & Wilcox boiler.

This foam preventer, or, more accurately speaking, the Potter mesh-separator and superheater, consists of a box or chamber, containing a number of layers of wire mesh or perforated plates, located in the steam space of the boiler, the form being modified to meet the requirements of each particular make of boiler.

Through its use perfectly dry steam is furnished to the engine. All the water is kept in the boiler, where it belongs. The employment and consequent

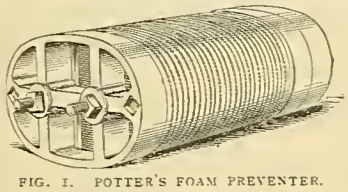


FIG. 1. POTTER'S FOAM PREVENTER.

care and maintenance of valves and traps is dispensed with.

How it does it, is the next question. The rapid opening and closing of the valve of an engine causes pulsations in the flow of steam, and this pump-like effect, transmitted to the boiler, causes the water to "lift."

These pulsations are broken up in this separator by the many layers of mesh, and the flow of steam is continuous from the entire surface of the water in the boiler, and water in a solid form is not "picked up."

The water contained in the steam in the form of small globules is broken into still smaller globules on striking the first layers of mesh, and then, on coming into contact with the remaining layers, it is still further broken, and finally flashed into dry steam. Owing to the increased temperature of the

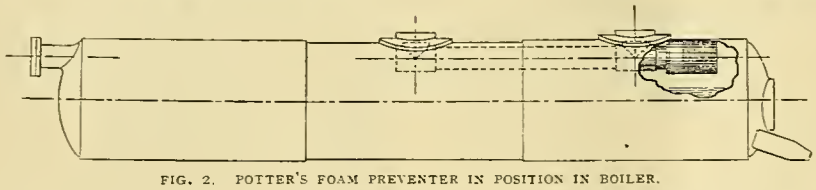


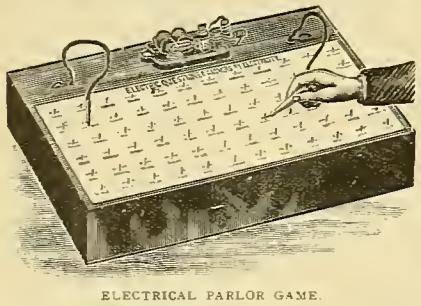
FIG. 2. POTTER'S FOAM PREVENTER IN POSITION IN BOILER.

mesh, caused by the friction of the flow of steam, a moderate amount of superheat is produced, and steam is delivered not only free from water, but superheated. Central-station or isolated-plant engineers will find this device worth investigating. It is manufactured by the F. D. Potter company, 39 Cortlandt street, New York.

It should be stated that the foam preventer is not a new device; it has been in service in many plants in New York and elsewhere throughout the East.

Electrical Parlor Game.

The word "electrical" in so many cases is a "curiosity exciter" that the Boston electrical game, illustrated herewith and now being manufactured by James S. Barron & Co. of 24 to 30 Hudson street, New York, should meet with ready sale. The game consists of 72 pins on top of a desk, over which a perforated card is placed, with 36 questions on the left side and 36 answers on the right. Twenty of these perforated cards accompany each game. The operation of the game is very simple,



ELECTRICAL PARLOR GAME.

and is as follows: The key attached to the left flexible cord is placed on any of the questions desired, the pointer then attached to the right flexible cord, and tap pins consecutively until the signal is given, when the answers can be taken from around that pin. The game is not only amusing, but instructive, as it answers 720 questions on many subjects, such as biblical, geographical, astronomical, conundrums, capitals of foreign countries, time required to digest meats, fish, vegetables, etc.; distances from New York to all important cities, distances from New York (by water) to foreign countries, statistics, the Civil War, battles and events, names of the presidents and other United States officials.

French Ribbon Weavers Using Electric Power.

Important improvements in the local industry of ribbon weaving, throughout the district of St. Etienne, France, have been made by the electrical distribution of power. It is estimated that about 30,000 looms are in use in this district, which includes the country surrounding St. Etienne within a radius of 25 miles. Until quite recently nearly all of these looms were driven by hand in the houses of the weavers, who worked for themselves at the ribbon trade. Many of the hand looms have now been turned into power looms, electricity being the motive power. The Electrical company of the Loire has been chiefly instrumental in providing the motors and furnishing the electricity. This company has several generating stations which furnish a total of 2,200 horse power. The current is distributed by means of a three-phase alternating system at 5,200 volts to 30 transformer stations over 68 miles of wire. At these stations the pressure is reduced to 190 volts for power and 110 volts for lighting purposes. There are 8,000 lamps now in use and 2,500 looms are operated by motors. It is estimated that each ribbon loom needs on the average one-fourth horse power, for which a charge of $2 a month has been fixed to cover all costs.

Ten-cent Copper Predicted.

It is now stated that there is little likelihood of a consolidation of all the copper-producing properties of the country under a combination engineered by the Standard Oil people. The New York correspondent of the Chicago Tribune says that the copper mines of Rowan and Cabarrus counties, N. C., which furnished all the copper used by the Confederacy and which are rich in ores, were recently bought by Boston and New York capitalists who are antagonistic to the trust, and who are supposed to be backed by the great electrical interests, and the new owners have organized the Union Copper Mining company under the laws of New Jersey, for the purpose of operating them. The capital of the company is $3,000,000, and it has already begun the erection of an expensive plant, and by January 1st next will be producing, it is said, 1,000 tons of ore a day, which will yield 200,000 pounds of pure copper a day. It is asserted that the company proposes to market the copper in New York at 10 cents a pound, which will give it a profit of four cents a pound.

Rochester Has a City Electrician.

Louis W. Miller has been appointed city electrician of Rochester, N. Y. Mr. Miller is a young man who has been connected with the police telegraphs of that city for a number of years. He has invented a protector for police and fire-alarm boxes, as well as several other devices. His practical experience will be of much benefit in his new and more important position.

Rochester has been without a city electrician for several years, since the resignation of Mr. Barnes, who left to engage in electrical work for the state. But last July a fireman met his death by contact with a converter on the outside of a building, and, as detailed in the Western Electrician at the time, the coroner's jury recommended that a city electrician be appointed, to see that all wires were properly strung, to inspect electrical construction and to instruct firemen and policemen. The Common Council acted on the suggestion and appointed Mr. Miller.

New York State Street Railway Association.

The seventeenth annual meeting of the New York State Street Railway association will be held at Ithaca, N. Y., on Tuesday and Wednesday, September 12th and 13th. An attractive programme has been arranged, and a good attendance is expected. Cornell University is located in Ithaca, and the faculty of that institution will help in the entertainment of the guests. Papers will be read by practical street-railway managers and engineers and also by some of the university professors.

Vickers Sons & Maxim of Sheffield, Eng., have, it is said, recently placed a contract in the United States for two electric battleship cantilever cranes and trestles and two electric cantilever yard cranes for their great shipbuilding works. This will be the largest shipment of cranes ever made to England from the United States, and it will form the largest electric plant of this kind ever erected in England. The contract calls for an expenditure of $350,000.

Eagle Dynamos and Motors.

The Eagle Electric Works of Peoria, Ill., are turning out an excellent line of dynamos and motors. A strong and rigid frame and simplicity in construction are noticeable. The details are carefully worked out, to combine high efficiency with economy. This enables the machines to be specially adapted for steady, hard work.

The base, the bearing supports, the field cores and pole shoes are all in one piece, which does away with broken magnetic joints, thereby increasing the efficiency of the magnetic circuit. The bearings

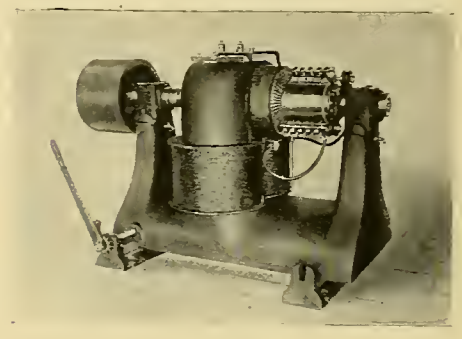


FIG. 1. EAGLE DYNAMO.

are self-oiling and spacious. The field coils are wound on metallic spools. The most careful attention is given to the building of the armature and commutator; the best material and the highest grade of insulation are used, assuring mechanical and electrical excellence. The brush-holders are likewise of the latest improved type.

In the accompanying illustrations Fig. 1 shows a bipolar dynamo arranged for belt drive, and Fig. 2 shows the type of armature.

The Eagle Works have lately increased their capital stock, and no doubt they will make themselves felt in the electrical trade.

New Phenomenon in Electric Discharge in Rarefied Gases.

A glass tube, 20 centimeters long and three centimeters in diameter, having a lateral opening, was closed at each end and the opening connected with a mercury air pump. Two rings of aluminum wire of 0.5 millimeter diameter encircled the tube 15 centimeters apart, and these were connected to the poles of an induction coil of a maximum sparking distance of 15 centimeters. During the exhaustion of the tube it appeared at first very much like an ordinary Geissler tube, except that the discharge was oscillatory. Each ring looked like a cathode and an anode at the same time, for the rarefied gas acted as one coat of a condenser and the rings as the other. Then, as the exhaustion continued, blue rings of light were formed beneath the aluminum wires, and after breaking loose from the walls, appeared as a double cone of light, which finally emitted bluish-green rays, having all the properties of cathode rays. This experiment is described by Ludwig Fomm in Wiedemann's Annalen.

Marconi to Appear before the British Association.

The annual meeting of the British Association for the Advancement of Science will be held at Dover this month. It is said that wireless telegraphy will be a leading topic of discussion and Marconi the

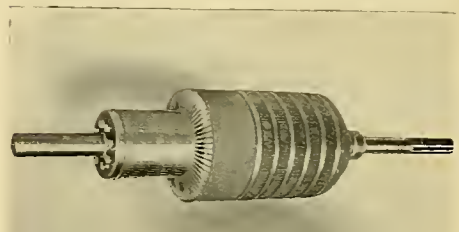


FIG. 2. ARMATURE OF EAGLE DYNAMO.

lion of the occasion. Messages may be exchanged without wires between the British and the French associations, meeting at Dover and Boulogne respectively, and Marconi will give an account of the recent experiments conducted by him at the British-fleet maneuvers and between Dover and the South Foreland lighthouse and the East Goodwin lightship. The Elder Brethren of Trinity House have been impressed with the utility of the system in communicating messages between lightships and the shore, and the admiralty has also discerned the importance of the invention in naval operations.

CORRESPONDENCE.

New York Notes.

New York, August 28.—The report of President Rossiter of the Brooklyn Rapid Transit company for the year ended June 30th was made public last week. The company has paid no dividend, though the earnings show a total net surplus of earnings over operating expenses up to June 30, 1899, of $678,128.75, an increase of $462,549.25 over the preceding year. During the year the company very nearly doubled the mileage. President Rossiter says: "It can now be said of the Brooklyn Rapid Transit system that in mileage of track it is the largest street-railway system in the world, comprising 504 miles, or more than twice the trackage of the Metropolitan Street Railway company, and 60 miles more than the Union Traction company of Philadelphia." Eight different railway lines were acquired or leased during the year, which necessitated an increase of capital stock to $45,000,000. In amount of passenger earnings the Rapid Transit road surpasses every street-railroad system in the world, with the exception of the Metropolitan Street Railway company

Copper still holds at about the same high price that has characterized it for some time past, and meanwhile new companies are being organized to take advantage of the opportunity. Three companies were organized on Saturday afternoon in Jersey City, and the articles of incorporation were sent to Trenton to be filed. The corporations are the Angang Copper company, capital stock, $1,000,000; the Oxide Copper company, capital stock, $5,000,000, and the Island Copper company, with a capital stock of $100,000, which will be increased to $10,000,000. The directors of the Angang company are Charles H. Dickey, Charles B. Burrage, Charles N. King and Edward E. Storey. These same men are directors of the other companies, with the addition of U. H. Broughton and Nathan F. Leopold in the Island company and George H. Sisson in the Oxide company. It is said that the Standard Oil people are backing these concerns.

It is asserted that the Manhattan elevated road will adopt the multiple-unit system controlled by the Sprague Electric company, the system which has been a success on South Side elevated railroad of Chicago.

The first death due to the new electrical equipment of the Brooklyn elevated railroad occurred Wednesday. Charles Culberson, a track walker employed by the company, slipped and fell across the rails while performing his duties, and a heavy current of electricity passed through his body, killing him almost instantly.

It is asserted that within a short time the Brooklyn Rapid Transit company will be in control of all the trolley roads now included in the systems of the New York and Queens County and the New York and North Shore railroads. When this consolidation is effected the Brooklyn Rapid Transit company will control all the Queens borough trolley roads except those belonging to the Long Island electric railroad.

One of the worst stoppages since the installation of the underground electric system on the surface lines of the Metropolitan Street Railway company occurred on Wednesday on the downtown section of the Sixth and Eighth avenue lines from Canal street to the Battery place terminus. The trouble was due to the flooding of the subway at Canal street and West Broadway, through which run the wires feeding that section of the line. The wires were covered with water and the fuses burned out. In constructing the subway at this point it was found necessary to pass in under a large brick sewer on Canal street. As that part of Canal street was formerly a swamp, the ground at the intersection was moist and stagnant water had been collecting for some time below the sewer, but its presence was not felt until Wednesday. It took a gang of 30 men six hours to pump out the water and repair the damage. M. S.

Northwestern Notations.

Minneapolis, August 26.—Sioux City, Ia., has passed an ordinance for the appointment of an electrical inspector.

The Citizens' Traction company of Oshkosh, Wis., has filed a trust deed for $500,000 to the Royal Trust company of Chicago. This company has got into another difference with the city officials of Neenah, Wis., where it is building a line. The franchise provides that on a certain street the tracks shall be laid on the extreme north. As this street is on the edge of a fill, and a good part of it has caved off, the company would have to fill up the washed-away portion. Instead of doing so, the company sought to lay its tracks in the middle of the street, as staked out, and avoid any grading. The city officials interfered and will hold the company to the franchise.

The Wausau (Wis.) Electric company invites negotiations from the council for the purchase of its plant.

The council of Elroy, Wis., rejected all bids for the electric-light plant and will put it in under the supervision of the electric-light committee.

All the holders of franchises for electric lines in the copper country on the upper peninsula of Michigan have retired in favor of Stone & Webster of Boston, who will build a belt-trolley line at once. The line is to be 35 miles long and is to be completed this fall.

An electric car at Merrill, Wis., was derailed on a bridge and thrown off the bridge into the river, a drop of 20 feet. The car turned completely over and struck on the top, but no one was seriously injured. Three passengers and the motorman were bruised and wrenched.

The electric-light plant at Glendive, Mont., was burned, with a loss of $6,000; insurance, $4,500.

W. H. Bradley of Tomahawk, Wis., is building an electric railway from Tomahawk to Clear Lake, Wis.

People of Lynden, Wash., want an electric-car line from Whatcom. There are a number of industries interested, and a meeting will be held to make a guarantee of the freight and passengers to be furnished.

Work is to be begun on the electric road to connect Tacoma and Seattle, Wash., within 30 days, and it is to be completed by April next. The company expects to make the trip, 33 miles, in 40 minutes.

Injunction proceedings have been begun at Stevens Point, Wis., to set aside the contract entered into between the city officials and the Stevens Point Lighting company. It is alleged that it was never legally done and that the price paid for lights is excessive. It is further claimed that the officials knew that cheaper lights could be secured, but did not wish to secure them.

Work is being pushed upon the Oshkosh-Neenah electric railway in Wisconsin, and it is expected that the line will be finished soon.

Frederick Ford of Madison, Wis., will draw plans and superintend the construction of the electric-lighting plant to be erected at Waupun, Wis.

Chicago capitalists have made a proposition to the city of Two Rivers, Wis., to construct a power house and furnish electric lights.

The Lake Geneva, Sycamore and Southern Electric Railway company has petitioned the City Council of Lake Geneva for a franchise to operate in the city.

The Crocker-Wheeler company has secured the contract for all electric and power-generating machinery to be placed in the paper mill at Wausau, Wis.

The plant of the Greeman Electric company at Sioux City, Ia., was blown up by dynamite, causing a loss to the company of $3,500.

An electric-light plant is being constructed at Blair, Wis., which will be operated by water power. It is claimed that lights can be furnished at a rate of 25 cents a month.

The Mankato Traction company has been organized at Mankato, Minn., with a capital of $50,000. It is proposed to operate a line between Mankato and Le Sueur.

The Burgess Electric company of Duluth, Minn., has secured a contract to place an 800-light plant in the normal school at Grand Forks, N. D.

City Electrician Alden of Tacoma, Wash., has completed plans and specifications for the light system soon to be constructed at that place. Bids for furnishing the current and operating the system will be taken shortly.

The Cannon Hill Street Railway company is a new company which has been organized at Spokane, Wash. A franchise will be asked from the city to operate in certain streets.

The Jamestown (N. D.) Electric Light company has been granted a 20-year franchise.

A site for the location of an electric power house for the town of Valley Junction, Ia., has been secured and work will commence at once upon the building and upon the system of lighting which will be put in.

The Edison Electric Light company of Des Moines, Ia., has filed a bond to secure the proper fulfillment of its contract to furnish 500 incandescent street lights for the use of the park board.

The Electric Light company of Cedar Falls, Ia., has ordered meters, which will be placed in all places where electric lights are used.

The Dubuque (Ia.) Street Railway company is making preparations for increasing the capacity of its power house and also for extensive improvements in the railway system.

The Ida Grove (Ia.) Electric Light and Heating company has let the contract for the erection of its new building.

J. M. Lue, who was employed as chief electrician on the Crescent, Ia., bridge, was drowned in the river while attempting to swim it.

The General Electric company of Minneapolis, Minn., is making preparations to enlarge its plant. A mortgage of $2,000,000 has just been filed, and part of this amount will probably be used for buildings.

Work has begun upon the power house which will supply Bemidji, Minn., with electric lights. It is expected that the system will be in operation in a few weeks.

The Town Board of Melrose, Wis., will vote on the question of the issuance of $9,500 bonds to aid in the construction of the La Crosse, Black River Falls and Neilsville electric railroad.

The matter of a local company to build the street railroad at Janesville, Wis., is being agitated, but as yet no definte action has been taken.

The Oshkosh and Neenah electric railway has completed several extensions which have been under way. A trial run over a part of the new line, which extends 10 miles from Oshkosh, Wis., was made in 18 minutes.

An arrangement has been perfected between the Wisconsin Central and the electric railway at Milwaukee by which passengers are transferred from Waukesha to that city by the latter road.

The Twin City Electric company at Grand Rapids, Wis., has decided to issue stock at $10 a share.

John R. Davis will dam the river near Chippewa Falls, Wis., and by the energy thus secured will operates the street-railway company and a pulp mill which he expects to erect.

The Jackson Milling company, located at Stevens Point, Wis., was given a franchise to operate an electric-light plant by the council, but the mayor has vetoed the ordinance.

It is probable that Elkhorn, Wis., will soon have an electric railroad. The Lake Geneva, Sycamore and Southern will probably be extended to that place.

A franchise to operate a street railroad has been asked from Lake Geneva, Wis., by St. Paul men.

There is talk at Racine, Wis., that a franchise for heating and lighting will be asked of the city by a local company. Nothing definite has been done about the matter as yet, however. R.

Detroit, Mich.

Detroit, August 26.—The Anthony Manufacturing company, which proposes to manufacture electrical apparatus, has filed articles of incorporation at Detroit. The capital is $5,000, with 40 per cent. paid in. E. E. Anthony owns 200 shares and C. H. Oakman and Hugh M. McCormack one share each.

An order for the dismissal of the case of the Western Electric company of Chicago against the Detroit Telephone company, in which the former claims that the latter has been infringing on four of its patents, will be presented to Judge Swan.

The new working agreement between the Employes' association and the local railway companies, embodying the 21-cent rate, has been signed and has been given immediate effect. The street-car employes and employers are now at peace; the threatened strike has been averted.

F. F. Ingram of the Electric Light Commission is of the opinion that, to still further cut down the expenses of the Public Lighting Commission, the men injured in the service of the commission should be attended by city physicians, instead of being turned over to doctors called in each case. The commissioner, who is deeply interested in keeping down expenses, says: "If such a scheme could be worked it would save a good deal of money."

The company building the new suburban electric railway from Detroit to Northville, through Pontiac and Farmington, has put out an issue of bonds, to run 20 years, secured by first mortgage. This road will run through some fine scenery and afford good pleasure riding in the summer months.

The large factory building erected 10 years ago by the Detroit Motor company, at the corner of Second avenue and the Grand Trunk railway, and soon abandoned, has been purchased by the Detroit Automobile company, and is being fitted up for the new line of business.

Conductor J. B. Schram of the Detroit Citizens' Railway company was discharged on April 1st, and the Street Railway Employes' union made an investigation of the case, with the result that the company has reinstated him, and he has received $230 back pay.

A motorman at Battle Creek leaned out of his cab window and gave a deaf woman a push that sent her headlong off the track and saved her from being crushed. She received only a few slight bruises.

Work on the power house of the Detroit and River St. Clair road, at New Baltimore, Mich., is being rushed, and when completed it will be one of the largest and most complete electric power houses in the world. It is expected that cars will be running from Detroit to Marine City by the end of August. The section of the road from Marine City to Port Huron is to be finished by January 1st.

Somebody stole a lawn roller weighing 300 pounds from the residence of County Auditor Hawley Christian, at Wyandotte, Mich., and placed it on the track of the Detroit and Wyandotte electric railway. The result was a damaged electric car and a badly smashed roller.

Walter A. Graham, a lineman employed by the city lighting commission, met his death on August 24th while painting a pole. He took hold of a live wire and his grip on it was so tight that his fellow-workmen had great difficulty in releasing it. He was then lowered to the ground by means of ropes, and the usual means of resuscitation employed, but in vain.

There has been under discussion among vessel owners at Detroit the possibility of adopting wireless telegraphy on the Great Lakes. Several owners here have suggested that the United States Lighthouse Board should take the matter up. The wireless system has proved successful. Why should it not be adopted on the Great Lakes? is the question many shipowners here are now asking. G.

Fayetteville, N. Y., is now being lighted by electricity.

PERSONAL.

Ralph D. Mershon of the New York office of the Westinghouse Electric and Manufacturing company was in Chicago last week.

Professor Arthur St. C. Dunston of the University of Kansas has been elected to the chair of electrical engineering at the Alabama Polytechnic Institute.

H. L. Doherty, the president of the Northwestern Electrical association, when in Chicago last week said that while it was too early to make predictions about the next Milwaukee convention of the association, he had every reason to expect a gathering of real benefit to members and visitors.

George M. Ellis, for 13 years superintendent of the General Electric warehouse at Chicago, has accepted the position of assistant manager of the Gregory Electric company and the Charles E. Gregory company. The addition of Mr. Ellis to the staff of the Gregory company should be an arrangement mutually advantageous and satisfactory.

J. H. Hallberg has resigned his position as electrician for the Standard Thermometer and Electric company of Peabody, Mass., to become electrical engineer of the arc-lamp department of the General Incandescent Arc Light company of New York. Mr. Hallberg was electrician for the Standard company for three years, during which period the Midget enclosed arc lamp was designed and perfected.

ELECTRIC LIGHTING.

The plant of the Rappahannock Electric Light and Power company of Fredericksburg, Va., has been sold to G. W. Shepherd.

The commissioner of Indian affairs has awarded to Franklin R. Anson of Salem, Ore., the contract for installing an electric-light plant at the Warm Springs Indian agency at $2,948.

A new company, to be known as the Lyons Electric Light, Heat and Power company, will build a $30,000 plant at Lyons, N. Y. The company is composed of Lyons and Syracuse capitalists.

A controversy that has been waged for some time in Washington over the price to be paid for the street arc lamps has been temporarily settled by the companies agreeing to furnish the lamps at $72 each for a year, until Congress acts on the clause which has been given two different interpretations by the parties concerned.

Several American manufacturing firms will be benefited by the orders given by the electric-lighting committee of Dudley, England. The council has been requested to accept the following bids for an electric-light and power station: Babcock & Wilcox, $10,085 for boilers and fittings; the Westinghouse Electric and Manufacturing company, $30,845 for machinery, etc.; Callender's Cable and Construction company, $35,750, and to Whittaker & Co., $27,330 for iron building, stack and engine beds.

The Treasury Department has awarded the following contracts for the installation of electric-light and power plants in various United States public buildings: Boston, Mass., generators, engines, etc., Westinghouse, Church, Kerr & Co. of New York, $18,619; Boston, switchboard, wiring, etc., D'Olier Engineering company, $3,694; Kansas City, Mo., generators, Eddy Electric company of Windsor, Conn., $8,125; Kansas City, engines, Ball Engine company of Erie, Pa., $9,200; Cincinnati, O., generators, engines, etc., Ridgeway Dynamo and Engine company of Ridgeway, Pa., $8,050; Cincinnati, switchboard, wiring, etc., J. F. Buchanan & Co. of Philadelphia, Pa., $9,760; Cincinnati, boilers, piping, etc., E. Keeler company of Williamsport, Pa., $19,450.

ELECTRIC RAILWAYS.

It is rumored that a syndicate intends to develop the water power of the Kankakee River at Kankakee, Ill., for the purpose of supplying electrical power for Chicago traction lines.

A number of Yale students are spending the summer vacation and earning money for college expenses by working as conductors or motormen on the Winchester Avenue railroad at New Haven, Conn.

A company capitalized at $150,000 has been incorporated to build an electric railway from Steubenville to Mingo Junction in Jefferson County, O. The incorporators are William Lipphardt, H. S. Sands, Lawrence G. Hallock, John H. McKee and Ferdinand H. Eick.

The Ladies' Home Journal says that the trolley car is popular with theater-going dwellers on Brooklyn Heights. While the play is in progress, it is said, the interior of the car is transformed from a drawing-room into a dining-room, and supper is served on the homeward trip.

The Concord, Maynard and Hudson Street Railway company of Concord, Mass., has been organized to construct a 20-mile electric railway through Hudson, Stow, Maynard, Acton and Concord. The directors are W. S. Reed, Leominster; E. E. Chain, Milford; C. H. Persons and Julius Loene, Maynard; J. H. Robinson and C. W. Woodbury, Hudson.

The property and franchise of the City Electric Railway company of Decatur, Ill., will be sold under a decree of foreclosure September 5th to satisfy the bonded indebtedness and defaulted interest, reported to be $19,618.

The City Council of Chattanooga, Tenn., has taken a hand in the fight against the Electric Railway company in sympathy with the locked-out union motormen. It has passed an ordinance requiring all motormen hereafter employed by the road to take 15 days' instructions under an expert motorman before they serve on the road.

Owing to the rapid growth of the electric-railway system, the state railroad-crossing board of Michigan has decided to require a separation of grades at all crossings of steam tracks hereafter made. This is a measure of safety to the public and is necessary for the making of time, the law requiring a full stop to be made at all grade crossings.

The Calumet Electric Street Railway company of Chicago has secured a right-of-way from the Pullman works through Pullman, paralleling the Illinois Central tracks from One-hundred-and-fourth to One-hundred-and-fifteenth street, Kensington. It is said that work on the road will be commenced immediately. By this arrangement the street-railway company will have a competing suburban line for the entire distance from Sixty-third street to Kensington.

The Detroit and Northwestern Railway company of Detroit, which was incorporated recently, with a capital of $500,000, has purchased the Grand River electric railroad and the Pontiac and Sylvan Lake railway of Detroit, and is now engaged in constructing an electric railway from Detroit, extending through Ravenswood, Greenfield, Sand Hill, Clarenceville, Farmington, Northville, Southfield, North Farmington, Orchard Lake, Pine Lake, Cass Lake, Sylvan Lake and Pontiac, a distance of 60 miles. The officers of the company are: President, Edward W. Voigt; vice-president and treasurer, Hoyt Post; secretary, James A. Randall; acting manager, Seymour Brownell; engineer, Fred A. Little; electrician, Louis Mouch, and mechanical engineer, J. F. Randall.

AUTOMOBILES.

It is expected that an automobile fete will be held at Pau, France, next February.

A service of motor vehicles is said to have been started between Rosas and Figueras, in Spain, a distance of 12 miles. The vehicles are of eight horse power and have a seating accommodation for nine passengers.

POWER TRANSMISSION.

The Yuba County (Cal.) Electric Power company is spending $600,000 in improvements. When completed the plant will be capable of supplying 15,000 horse power and will have facilities for increasing the capacity to 20,000 horse power when necessary.

California and Switzerland lead the world in the transmission of electricity generated by hydraulic power. California's waterfalls are estimated to have 240,000 horse power. They now supply 45,000 horse power in electrical energy to Los Angeles, Sacramento, San Diego and several other towns.

There is a plan on foot in the cotton-mill section of North Carolina for the development of water power on a large scale. The North Carolina Power company has purchased all rights along an eight-mile stretch of the Yadkin River, and will erect a power house to transform the hydraulic power for electrical distribution throughout the district. It is stated that 60,000 horse power will be available. The electrical energy developed will be distributed to mills, factories and shops within a radius of 40 miles.

The Empire State Power company was recently incorporated with the secretary of state of New York, with a capital of $1,000,000, to develop and sell electricity for light, heat and power purposes in the counties of Montgomery, Fulton, Schoharie, Schenectady, Albany and such other as it may desire. Schoharie Creek and its tributaries will furnish the power. The company will have its principal office in Amsterdam. The following-named are the directors of the company: William T. Mayer of Albany, J. George Kaelber of Rochester, Samuel Bolton, Jr., and Ralph S. Everest of Lansingburg, D. A. Devendorf of Fort Hunter, W. Barlow Dunlap of Amsterdam and Clarence E. Sprout of Williamsport, Pa.

PUBLICATIONS.

The Ward Leonard Electric company of Bronxville, N. Y., is distributing to the trade a catalogue of its enamel field rheostats of the Carpenter type and also separate price-lists of speed regulators and rheostats of other designs.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, dealers in manufacturers and machinists' hardware of every description, are sending to the trade a 300-page catalogue and price-list of their fine tools. The catalogue retains its well-known and convenient pocket size.

A new and attractive catalogue is issued by the Joseph Dixon Crucible company of Jersey City, N. J., which contains many interesting facts concerning the graphite productions of the company. Attention is called to the different uses to which the graphite products may be applied by electricians.

"Some Suggestions About Ithaca and Its Business Resources" is the title of a handsomely illustrated booklet that has been published by the Business Men's association of Ithaca, N. Y., and is being distributed by the Ithaca Street Railway company. The distribution of the book, which makes an attractive souvenir, is apropos, as the convention of the New York State Street Railway association is to be held in Ithaca on September 12th and 13th.

Some valuable literature is being sent out by the Montauk Multiphase Cable company, 100 Broadway, New York city. Of special interest to electrical men is the company's "Installation and Specification Hand-book." This book is very complete and not only describes the Montauk multiphase cable and shows how to install it, but also gives forms for making estimates and methods of making proposals, so that there is nothing which the installing electrician desires to know in regard to the installation of this cable that cannot be found in this book. A number of drawings showing different methods of installation are a special feature of the book, which is intended to put the installing electrician in a position to do business in the new insurance field afforded by the product of the Montauk company. The new price-list enumerates many additional styles of cable and other data useful to the buyer. "Facts Regarding the Cable" supplies arguments to influence prospective purchasers. A little pamphlet is also issued, containing a copy of a lecture delivered by Joseph Sachs on the "Electrical Safeguards of a Great City," in which mention is made of the company's thermostatic wire.

TELEGRAPH.

The Florida end of the Miami-Havana cable has been landed at Miami.

The government of Mexico has awarded a contract for the laying of a cable from the port of Altata, state of Sinaloa, to Lopaz, Lower California, a distance of 114 miles. The work must be completed within six months.

The Eastern Extension Telegraph company of London is said to have made an offer to the Victorian government to lay a cable from Australia to South Africa without cost to the colonies. The company requires neither a subsidy nor a guarantee.

A Bremen correspondent of the Chicago Record says: "The Turkish and Roumanian governments have finally granted the much-mooted concessions for the laying of a telegraphic cable in the Black Sea, from Constanza, Roumania, to Constantinople, and a syndicate to do the work and operate the enterprise has been organized at Berlin under the style of the Eastern European Telegraphic company. The Dresden Bank is the chief financial backer of the undertaking."

The Spokane and Northern Telegraph company will make some important extensions into the Boundary Creek Country, near Rossland, B. C. The new line will be constructed from Marcus, where connection will be made with the line running to Rossland, Spokane, Grand Forks, Cascade, Columbia, Greenwood and Midway. From the latter point it will go down the Kettle River to Curlew and then to Republic. The latter place will thus be given direct communication with leading Boundary points.

In a recent article Mr. Henniker Heaton puts forth a plea for a cheap telegraph system, to extend throughout the British empire. His project is to utilize, as far as possible, overland wires and thus supplement the cables. The projected land lines are three: 1. London to Tiflis, Tiflis to Merv, Merv to Peshawur (600 miles only to be constructed), Peshawur to Sadiya, Burmah northeastern frontier; Sadiya to Hongkong, Hongkong to Shanghai. From this route it will be seen that by linking up the 600 miles across Afghanistan a message can be sent from London to Hongkong and Shanghai by land. 2. Calais to Constantinople, thence to Suez and Cairo, and from Cairo to the Cape. This land line is already being constructed. 3. Calais to Constantinople, thence to Fao, at the head of the Persian Gulf; from Fao to Bushire and Jask, and thence to Kurrachee and India.

J. Kajiura, an engineer in the Bureau of Telegraphy of the Department of Communications, in Japan, was in New York recently. "The government of my country has sent me to investigate your system of telegraphy," he said to a Tribune reporter. "We admire your ways of doing business and are indebted to you for much valuable information. We believe that the United States is the most progressive nation in the world and we feel perfectly safe in copying your methods. In Japan we have the Morse system of telegraphy and about 1,000 miles of wire. We can send messages as rapidly as you can, but our system of delivery is not so good, because we

have not the pneumatic tubes. It is a part of my mission to investigate these, with a view to establishing them in my country. I will also look into your telephone system. There are a great many telephones in Japan now, and the number is increasing every day."

Advices from Salt Lake City give the information that the Postal Telegraph-cable company of Utah has been incorporated, with a capital of $50,000, for the purpose of constructing, maintaining and operating telegraph lines in, through and between the various cities and towns in the state. Work will be begun at once and the construction of the line through to the coast will be pushed forward with dispatch. Headquarters for the Utah, Idaho, Montana and Wyoming division will be located in Salt Lake City. The officers of the company are: President, A. L. Thomas; secretary, E. P. Gaylord; treasurer, W. S. McCormick.

ELECTRICAL SECURITIES.

The committee on stock list of the Chicago Stock Exchange has admitted the securities of the Chicago Union Traction company to the unlisted department. The first sales were at prices ranging between 37½ and 38¾ for the common stock, the preferred selling between 83¾ and 84.

MISCELLANEOUS.

It is said that a deaf-mute recovered his hearing and speech recently by being stunned by lightning at Harpersfield, N. Y.

A novel method of testing the efficiency of coverings for steam pipes electrically has been devised. A section of the steam pipe is heated electrically by means of a coil of wire in oil within the pipe. The amount of energy necessary to keep the pipe at a definite temperature is measured. Since the energy supplied is just enough to maintain a constant temperature, it must therefore equal the heat lost from the pipe. Hence, from the electrical energy supplied the heat lost from the outside of the pipe can be calculated. The new method was recently described by Professor Charles L. Morton.

A Massachusetts inventor has devised what is called a "mechanical rat." It consists of a piece of clockwork driving three rubber-tired wheels, which can be made to travel 400 feet by one winding of the spring. The diminutive automobile is first sent through a pipe to drag through a string, which can then be used to pull the wire or cable through, or pull a larger-sized string or rope of sufficient strength to haul the cable. It is said that it is much more expeditious than the old method of running cables through conduits by shoving sticks coupled together into the pipe one at a time until the first stick reaches the other manhole.

TRADE NEWS.

The Stilwell-Bierce & Smith-Vaile company of Dayton, O., has opened a branch office for St. Louis and adjacent territory at 601 Burlington building, in that city. Louis Bendit is in charge.

The Moloney Electric company of St. Louis, Mo., is now represented in Chicago by the Illinois Electric company, which carries a full and complete stock of transformers and can fill orders promptly.

The Clonbrock Steam Boiler company of Brooklyn has opened a Chicago office, in charge of Mr. H. B. Ham, 457 Monadnock block. This step was necessary to take care of the constantly increasing western business of the Clonbrock company. Mr. Ham is well known, having had an extensive experience in the boiler business. He was for a long time connected with the Boston office of the Babcock & Wilcox company. He is an energetic worker, and it is safe to say that the business of his company will be largely increased through his efforts.

E. W. Hammer, the president and general manager of the Chicago Rheostat company, has been in the East during the last two months in the interests of his company and has established a branch factory in New York city for the manufacture of his products. This extension was made necessary by the rapidly growing eastern and export business of the company. The Chicago Rheostat company has enjoyed a phenomenal growth during the last year under Mr. Hammer's management, notwithstanding the active competition in the rheostat business. Mr. Hammer will devote most of his future efforts to the upbuilding of the eastern factory and may later on remove to New York with his family. The New York address of the Chicago Rheostat company is No. 39 Cortlandt street.

William Roche, 42 Vesey street, New York city, the inventor and manufacturer of New Standard dry cells, reports flattering orders at good prices for his cells from the best class of battery users. He says that railroad, telephone and slot-machine companies are beginning to realize that a couple of cents in first cost is no saving when they can get a genuine, reliable dry cell at an honest price. Mr. Roche attends to every detail of the manufacture of his cells, and although the batteries have been sold under his name less than two years, still they have gained a wide reputation. He has invented and manufactured for others cells that are extensively known throughout the country, but he states that the cells he is now making under his own name will surpass any he has made for others.

The corporation formerly known as Meysenburg & Badt of 1504 Monadnock block, Chicago, has changed its title to that of the Badt-Goltz Engineering company, Mr. Edward A. Meysenburg having resigned as an officer of the company and retired from participation in the active management. Mr. F. B. Badt remains the president of the company and Mr. William Goltz the secretary. Lieutenant Badt's reputation as an electrical engineer is widely extended. Combined with a taste and capacity for the investigation of scientific and technical problems, he has a practical experience in electrical designing and expert work that reaches back to 1882, when he joined the staff of the old United States Electric company. Since that time Lieutenant Badt has been engaged in almost every department of electrical work; he has written electrical books, and has acquired a fund of valuable information. Mr. Goltz is a somewhat younger man, but has also had several years' practical experience in electrical construction. The company is, therefore, well equipped to execute engineering commissions.

BUSINESS.

The Electric Appliance company, Chicago, is sending out descriptive circulars of its Newgard waterproof receptacle, which is said to be a boon where the weather or dampness has a chance to work on lamp connections.

Highest market prices and prompt remittances are what the Swarts Metal Refining company offers to those having old scrap-copper wire for sale. The Swarts company is one of the largest and best-known concerns in this business and has earned an enviable reputation among electrical men for honesty of dealing.

The Triumph Electric company is working an extra force of men day and night to keep up with its orders. It has had an unprecedented demand during the last two months for special applications of direct-connected motors for factory transmission and for railway generators. One customer, who has been using a Triumph 100-kilowatt railway generator in connection with several other machines, states that the former is his standby whenever he has heavy days; that he has the circuit-breaker set for over 50 per cent. overload, and runs it there all the time, and that the machine never gives him the slightest trouble. The Triumph company is now getting out some large-sized generators for several roads, and the excellence of the design is appreciated by railway men.

The Western Electric company carries in stock some neat novelties in the way of portable battery lamps. The Emergency flashlight is made in three sizes, cylindrical in form, the diameter of all being the same, and their length being respectively 8½, 11 and 13 inches. These lights are said to give from 6,000 to 8,000 flashes before the battery requires renewal. They are extremely useful where a light is wanted quickly. The company is distributing its catalogue descriptive of this device. This catalogue also illustrates the ever-ready electric walking cane, interior searchlight, electric gas lighter, surgical and dental lamp, electric bicycle lamp, ever-ready night lamp, electric candle, ornamental banquet lamp, electric ruby lamp for photography, portable reading lamp, the ever-ready scarf pin and other battery novelties. A copy of this catalogue may be obtained by writing to the Western Electric company of Chicago.

The amount of money-earning time wasted every day in the shops of the land through stopping to take up belts because they are slipping is very large. If a belt did not slip it would be unnecessary to take it up until the sides touched. The Cling-surface Manufacturing company of 177-182 Virginia street, Buffalo, N. Y., reports that it has thousands of belts fulfilling these conditions through the use of Cling-surface. The Journal Printing company of Muscatine, Ia., writes: "We have been using your Cling-surface on our belts for the past two months, and unhesitatingly pronounce it an ideal article. We are able to run our machinery now with ease and accuracy, that was formerly very imperfect because of belts slipping. We now transmit our power a long distance by belts that are slack, and can start up heavy machinery with ease, where before they had to be lifted over by hand. Cling-surface is all and more than is claimed for it, and we can most heartily recommend its use to all who drive machinery by belting. Our belts were never in better shape. Cling-surface did it."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 22, 1899.

631,271. Telephone. John Q. Black, Lone Rock, Wis. Application filed March 4, 1898.

The telephone combines a line wire, a receiver connected directly to the line wire, a ground wire leading away from the rear end of the receiver through induction coils, a shunt wire leading from the rear end of the receiver to the ground wire at a point beyond the induction coils, and an elastic metal key on the receiver at its rear end in contact with the line wire but normally out of contact with other wires, the key being adapted by the pressure of the finger of the holder of the receiver thereon to be moved into contact temporarily with the shunt wire, thereby closing the shunting circuit. (See cut, next page.)

631,277. Electric-alarm Water Column. Martin L. Bush, Lawrence, and Charles F. Swain, Methuen, Mass. Application filed April 8, 1899.

The weight and float of a water column are connected by means of a lever and a circuit closer to a battery and alarm wholly outside of the cylinder and insulated therefrom.

631,278. Thermostat. Joseph Butcher, Jersey City, N. J. Application filed October 22, 1898.

A thermostat having a base provided with a spring tongue, a thermostatic element secured at one end to the free end of the tongue and extending back over the tongue whereby the free end of the element is adjacent to the fixed end of the tongue, electrical contact terminals adjacent to the free end of the element, and means for moving the free end of the tongue laterally.

631,289. Maximum-demand Meter. Walter C. Fish, Lynn, Mass., assignor to the General Electric company of New York. Application filed March 10, 1899.

The combination of an electromagoetic ammeter with an indicator, and means for advancing the indicator progressively as current is indicated and for stopping its advance when the current indication falls below the maximum already recorded.

631,290. Electric Meter. Walter C. Fish, Lynn, Mass, assignor to the General Electric company of New York. Application filed April 7, 1899.

An integrating wattmeter has combined in it a series field, a retarding device, a counting device and an armature in shunt to the mains, with an additional or starting winding supplied with substantially constant current and working in a substantially constant field for overcoming the friction of the instrument.

631,303. Electric Switch. Gerald W. Hart, West Hartford, Conn. Application filed December 5, 1898.

The switch has an operating part, a spring frame separate but co-operating with it, a carrier, a latch operated by the operating part and coacting with the carrier, a spring for advancing the carrier when released, and a spring for returning the frame and carrier when the latter is again released.

631,304. Snap-switch. Gerald W. Hart, West Hartford, Conn. Original application filed December 5, 1898. Divided and this application filed March 1, 1899.

One claim reads: In a snap switch a movable contact member normally locked in one position, an operating part, the contact member being unlocked and shifted into another position by a stroke in one direction of the operating part and there locked by a slight retractive movement of the operating part, and means to unlock the contact member and shift it into its original position by a second stroke of the operating part in the initial direction.

631,313. Electric Arc Lamp. Frederick McIntosh, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 16, 1897.

An electric arc lamp having the arc inclosed in a chamber of refractory material whose spectrum is rich in chemical rays, a casing for the material and an expansion space between the two, filled with a refractory yielding heat-non-conducting material, such as asbestos. (See cut, next page.)

631,316. Device for Lighting Lamps by Electricity. Svend M. Meyer, New York, N. Y. Application filed February 5, 1898.

The device comprises a suitable source of electricity and conductors, a rock shaft having a projecting arm and an incandescing device carried thereby, a circuit-closing device, closing the circuit through the incandescing material at mid-stroke of the rock shaft and a spring operating to throw the rock shaft to either extremity of its oscillating movement.

631,322. Oxidant for Electrical Batteries. Leonard Paget, New York, N. Y., assignor to the Reliance Lamp Electric company of New Jersey. Application filed July 8, 1897.

The method of manufacturing positive electrodes for storage batteries, which consists in placing a mass of lead of convenient form in an electrolyte consisting essentially as to its active agent of a peroxide of chlorine dissolved in a strong solution of sulphuric acid of good conductivity, making this mass the anode for an electric current, and adjusting the current so that a potential difference of about three volts is established between the anode and a cathode of lead.

631,339. Clutch for Electric Arc Lamps. Henry C. Spinney, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 13, 1899.

The combination of a movable rod or tube, a clutch for controlling certain movements of the rod or tube, an actuator for the clutch, and an adjusting device for the clutch, consisting of an open-sided box in which a nut is located.

631,343. System of Electric Metering. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed March 21, 1898.

The system has in combination one or more meters located at or near the translating devices, for regulating the amount of energy consumed, with a step-by-step means for changing the registration of the meter which is actuated

by a number of current impulses controlled from a point distant from the meter. (See cut.)

631,354. Telephone Receiver. Joseph A. Williams, Cleveland, Ohio, assignor to the Williams Electric company, Cleveland, Ohio. Application filed April 9, 1898.

A telephone receiver having the coil-bearing bobbin supported independently of the magnet and provided with a magnetic hub or core that forms the tip of the adjacent pole of the magnet, and the body portion of the pole consisting of magnetic strands or wires bunched and shiftable within the tip and suitably attached to the adjacent portion of the magnet.

631,355. Telephone Receiver. Joseph A. Williams, Cleveland, Ohio, assignor to the Williams Electric company, Cleveland, Ohio. Application filed December 28, 1898.

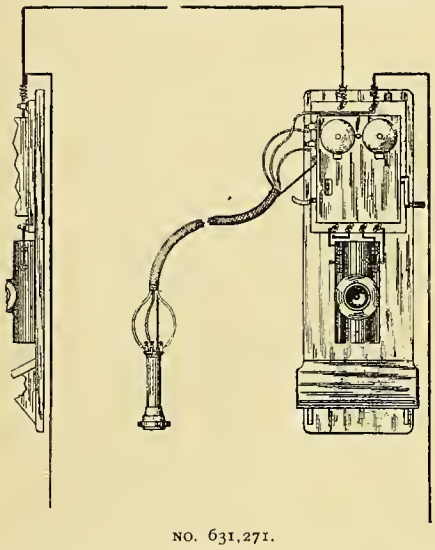
The features are the combination with the case or shell enlarged at one end to form the bobbin-receiving chamber and having an internal annular shoulder at the inner end of the chamber, of the double bobbin within the chamber, a disk having the bobbin fixed to its outer side, and three screws arranged equidistant apart along the surrounding edge of the disk and having respectively two annular shoulders closely overlapping opposite sides respectively of the disk, which screws are screwed into the shoulder.

631,356. Magneto-electric Telegraph. Leonidas G. Woolley, Kenton, Ohio, assignor to the National Magneto-electric Telegraph company, Springfield, Ohio. Application filed August 1, 1898.

In a magneto-electro generator are a revolving armature and a mechanism for causing it to revolve, combined with a pivoted key, and means attached to the armature shaft for controlling the partial revolutions of the armature. (See cut.)

631,360. Electric Heater. John L. Creveling, New York, N. Y. Application filed January 27, 1898.

An insulating core for electric heaters, comprising a plurality of separable individual core sections, each section being provided with a separate coil-retaining support.



NO. 631,271.

631,361. Trolley-pole Catcher. Cornelius A. Davis and Henry M. Wilson, Somerset, Mass. Application filed November 18, 1898.

The catcher has a lower weight for automatically taking up the slack of the trolley-pole rope, an upper additional weight or weights for assisting in pulling down the pole, and spring detents for the additional weights adapted to be tripped by the lower weight.

631,395. Jacquard Card-punching Device. Tony David, Lyons, France. Application filed May 10, 1898.

The claim reads: In combination, a card divided into metallic zones representing different colors insulated from each other and each zone representing wefts of the same color or nature, circuit connections and switch means to place the zones separately and successively into the electric circuit.

631,421. Facsimile Telegraph. William P. Dun Lany and Thomas Mills, Cleveland, Ohio, assignors to the International Facsimilegraph company, Cleveland, Ohio. Application filed January 8, 1898.

The apparatus combines a telegraph line, a Morse set of instruments, a facsimile set of instruments including a platen, a vibrating receiver, a relay for governing the same, a motor for causing relative movement between the vibrating receiver and the platen and suitable switch mechanism adapted to disconnect the Morse system and connect its local battery with an electrically operated part of the facsimile system.

631,452. Column Printing Telegraph. John E. Wright, New York, N. Y. Application filed March 10, 1898.

A printing-telegraph receiver is combined with a local-alarm circuit, a circuit-closer therein, an escapement, and means operating a movable part of the receiver mechanism to engage the circuit-closer when the escapement is brought to a predetermined position.

631,453. Telegraphic Relay. John E. Wright, New York, N. Y. Application filed March 10, 1898.

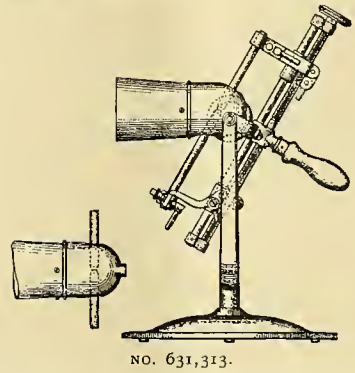
In a relay instrument the combination with a magnet and two sets of contact stops of two vibrating tongues or armatures, the axes of which are connected but with lost motion between them.

631,454. Telegraph Transmitter. John E. Wright, New York, N. Y. Application filed May 5, 1899.

The transmitter has in combination a pin barrel, a driving shaft imparting rotation to the barrel through a worm-gear, a series of keys, an electric circuit adapted to be closed by the contact of any key with its corresponding pin, a locking device for arresting the rotation of the driving shaft, and an electromagnet in the key-controlled circuit for operating the locking device.

631,467. System of Electric Metering and Apparatus Therefor. Rudolph M. Hunter, Philadelphia, Pa. Application filed November 15, 1898.

The method of registering electric current in coosumers' circuits which consists in supplying the consumption or load circuits with a current of electricity after it has energized an electric meter, and automatically causing the meter to register more rapidly per ampere of current consumed when the current consumed is irregular in amperes than when the consumption is maintained uniform or substantially constant.



NO. 631,313.

631,468. Method of and Apparatus for Producing Alkali Salts. Carl Kellner, Vienna, Austria-Hungary. Application filed October 23, 1897.

An electrolytic apparatus comprising a decomposing cell having electrodes, a source of electric supply connected therewith, an oxidizing cell having electrodes and a short-circuit for the latter electrodes forming part of the supply circuit.

631,491. Preventing Accidents on Drawbridges to Electric Cars. Samuel L. Phillips, Washington, D. C. Application filed May 2, 1899.

The system coosists in automatically breaking the power circuit by opening the draw, and thereby depriving the section of the railway approaching the draw of electric power, and restoring the power by replacing the draw in its position of safety.

631,497. Electric Switching System. John Brennan, Jr., St. Louis, Mo. Application filed July 11, 1898.

The combination with a trolley wire of an insulation frame, contact-making devices adjustably mounted on the frame, and projections on the trolley for co-operating with one or the other of the contact-making devices.

631,503. Electric Meter. Caryl D. Haskins, Newton, Mass., assignor to the General Electric company of New York. Application filed June 24, 1898.

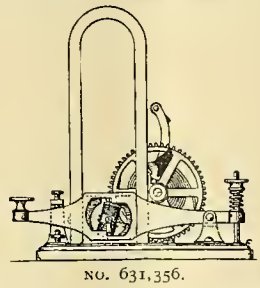
The meter, which is capable of running forward and backward, has in combination an element influenced by the current flowing in the system, an element influenced by the potential of the system, the two elements being capable of movement with respect to each other, and means for changing the relation of the elements so that the meter will register at one rate for a given flow of current while moving in one direction, and at a different rate for the same flow while traveling in the opposite direction.

631,505. Audiphone. Reese Hutchison, Mobile, Ala., assignor of one-half to James Howard Wilson, Mobile, Ala. Application filed March 15, 1899.

The audiphone combines an electrical circuit, an electrical receiving instrument and a plurality of earpieces in the current adapted to reproduce sounds received in the receiving instrument, each earpiece being provided with a regulator to control the intensity of the sounds reproduced at will, and adapted to remain at any desired point of adjustment, and a main-current regulator.

631,511. Electric Clock. Arthur F. Poole, Washington, Pa. Application filed June 23, 1898.

An electric clock is described having a switch consisting of a tube containing a conducting liquid, the tube having electrodes projecting thereinto, a clock mechanism arranged to swing the tube in one direction, an electromagnet arranged to swing the switch in the opposite direction and a retarding connection between the magnet and the switch arranged to slow down the movement and prevent splashing of the mercury and irregular completion of the circuit.



NO. 631,356.

631,518. Electric Motor or Generator. James Burke, New York, N. Y. Application filed December 27, 1898.

There is combined with the magnet frame of the machine a cradle adapted to support the armature of the machine and be supported by the magnet frame.

631,555. Thermostatic and Electrical Ventilating Device. Oscar L. Billings, Philadelphia, Pa., assignor to Samuel W McMunn, trustee, Chicago, Ill. Application filed August 24, 1898.

A ventilating apparatus comprising an air-inlet opening at the lower part of an apartment, a valve therein, a weight or its equivalent holding the valve normally closed, an exit aperture at the upper part of the apartment, a valve controlling the same, a thermostat connected with and operating with the valve and an electric actuating device for the valve of the inlet opening, the electric actuating device being controlled by the movement of the valve of the exit opening.

631,558. Phonograph. Josef Chania, Lemberg, Austria-Hungary. Application filed September 14, 1898.

An apparatus is described combining with a source of light a suitable body having the record to be delivered on its surface, and an electric circuit including a sounding device and a series of variable resistance devices, the light being adapted to be transmitted from its source onto the record and thence to the variable resistance devices.

631,596. Attachment for Electric Trolleys. Herman Stuempfle and John Delane, Terre Haute, Ind. Application filed February 9, 1899.

An attachment for trolleys comprising a harp or forked socket provided at its inner end with an angular clamp open at one side, a set-screw through the side thereof, and a substitute wheel journaled in the arm end of the socket.

631,623. Electrical Fountain Brush. Charles Dichl, Philadelphia, Pa. Application filed July 20, 1899.

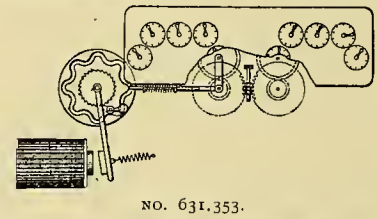
The hair brush described comprises a fountain brush having water-supply tubing attached thereto and having spraying perforations by which the water is directed through the bristles, and electrical connections by which the electricity is conducted to the water passing out from the perforations.

631,628. Electric Lighter for Incandescent Burners. Charles T. Farnham, Manchester, N. H. Application filed March 27, 1899.

The features enumerated are a support, a hooked electrode fixed to and insulated from the support, guides on the support, a push rod mounted to slide vertically in the guides, a yielding electrode carried by the rod and adapted to coact with the fixed electrode, a retracting spring surrounding the rod and an apertured flange on the support, adapted to be clamped between a gas pipe and the stem of a burner.

631,631. Electric Alarm Clock. Jacob Goldenberg, Nicholas Komow and Lion Gutterman, New York, N. Y. Application filed September 20, 1898.

The clock described has in combination with a casing having an open rear end and a time mechanism in the casing, an electromagnet carried by the rear face of the time-mechanism frame, an alarm sounder operated by the electromagnet, contact springs carried by the time-mechanism frame, a battery forming a closure for the rear end of the casing and removably secured therein, the front wall of the battery forming one of its poles and with which one of the contact springs engages, and a two-pronged yielding contact, mounted to slide in the casing and adapted to be slid into engagement with the other pole of the battery and the other contact spring.



NO. 631,353.

631,633. Electric Push-button Cut-out. James I. Gunther, New York, N. Y. Application filed April 15, 1899.

The combination with an insulating base block, and a casing secured thereon having an aperture in its top, of a spring-supported push button in the aperture, a cylindrical insulating block rotatable above the base block, two oppositely held and electrically connected contact strips on the insulating block, a four-winged bracket on the end of the insulating block separated from the contact strips thereon, a bent pusher bar connecting the push button with the plate spring therefor at one side of the insulating block, a spring finger projecting from the push button and adapted to engage successively with the wings of the bracket and give a quarter revolution to the insulating block for each depression of the push button, two spring-contact fingers pressing upon the insulating block and contact strips successively as the insulating block is given quarter revolutions, and two conducting wires in electric connection with the contact fingers.

631,649. Electric Arc Lamp. George R. MacIntire, New York, N. Y., assignor of one-half to Elliott P. Gleason, New York. Application filed February 28, 1898.

The lamp combines a frame or shell and a solenoid supported thereby, a conducting carbon holder insulated from the frame or shell, a connection from the solenoid to the holder electrically independent of the frame or shell, means for maintaining contact between the carbon and the holder, a core for the solenoid secured to the holder, a clutch carrier secured to the holder, and a clutch piece of insulating material mounted in the carrier to make contact with the carbon in the holder.

631,700. Illuminated Street-car Sign. Edward E. Dodge, Providence, R. I. Application filed June 8, 1899.

A street-car sign illuminated by electric lamps is described.

631,733. Electrode for Electric Belts. Frederick G. Bonfils and John D. Alkire, Jr., Denver, Colo. Application filed January 9, 1899.

An electrode is described comprising two disks, a bolt connecting them, a body-engaging surface composed of chamois or other suitable soft material, absorbent material interposed between the chamois and one of the disks, and a conductor leading from the bolt to the battery of the belt or other similar device.

631,748. Electric-lighting Device for Incandescent Gas-burners. Svend M. Meyer, New York, N. Y., assignor to William H. Seidel and William C. Tegethoff, New York. Application filed June 23, 1898.

A device for incandescent gas burners is described which combines a gas burner, a jet tube for igniting the same, a gas cock opening communication with the gas burner and subsequently with the igniting jet by a further movement in the same direction, an electric-lighting device for the jet tube and a circuit-closing device closed by the extreme movement of the cock by which the lighting jet is opened and broken in the intermediate position in which the main burner duct is open.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, SEPTEMBER 9, 1899. No. 11

Wrecking a Bridge by Electricity.

An interesting feat was accomplished in Clinton, Ind., on August 18th, when the old wooden wagon bridge over the Wabash River at that place was wrecked by electricity. The bridge was built in 1853. It was a frame structure, supported on stone piers, as shown in the upper illustration of the group given herewith. It consisted of three spans, with a 70-foot draw over the navigable channel of the stream. The total length was 735 feet. At one period the bridge belonged to a stock company, but at the time of the wrecking it was the property of one man. It was the only toll bridge in the state of Indiana, and the toll schedule is seen in the picture prominently displayed on the sign at the entrance to the bridge.

With the progress of time the old bridge became antiquated, and it was decided to replace it with one of more modern design and of durable construction. The county authorities purchased the approaches, piers and abutments and entered into contract for a new steel superstructure to be erected on the existing piers and abutments, which were of ample strength and in good condition. The owner of the old bridge agreed to remove the frame structure within 30 days. He found, however, that this was no easy accomplishment. He traveled about, consulted bridge and house wreckers, wrote letters and sent telegrams, but all to no purpose; no company or individual was found that would agree to take down the timbers, leaving the masonry intact, in the time available. The 30 days passed, and the old bridge still stood. The owner succeeded in getting an extension of a week, but he was at his wits' end. The structure could be blown up with dynamite, but the explosion would destroy the piers also. It could be set on fire, but that would crack or injure the masonry. Several other plans were suggested, but the only sure way seemed to be the erection of false work, and that method was out of the question, owing to the shortness of the time allotted for the work.

At this juncture Mr. H. N. Mills, an electrician living in Clinton, suggested the use of electricity. He agreed to wreck the wooden bridge structure without injuring the piers. Although the undertaking was a novel one, Mr. Mills was confident that his method must prove successful, and he was right. His offer was gladly accepted. The method adopted was perfectly simple; and this is the way it was put into execution:

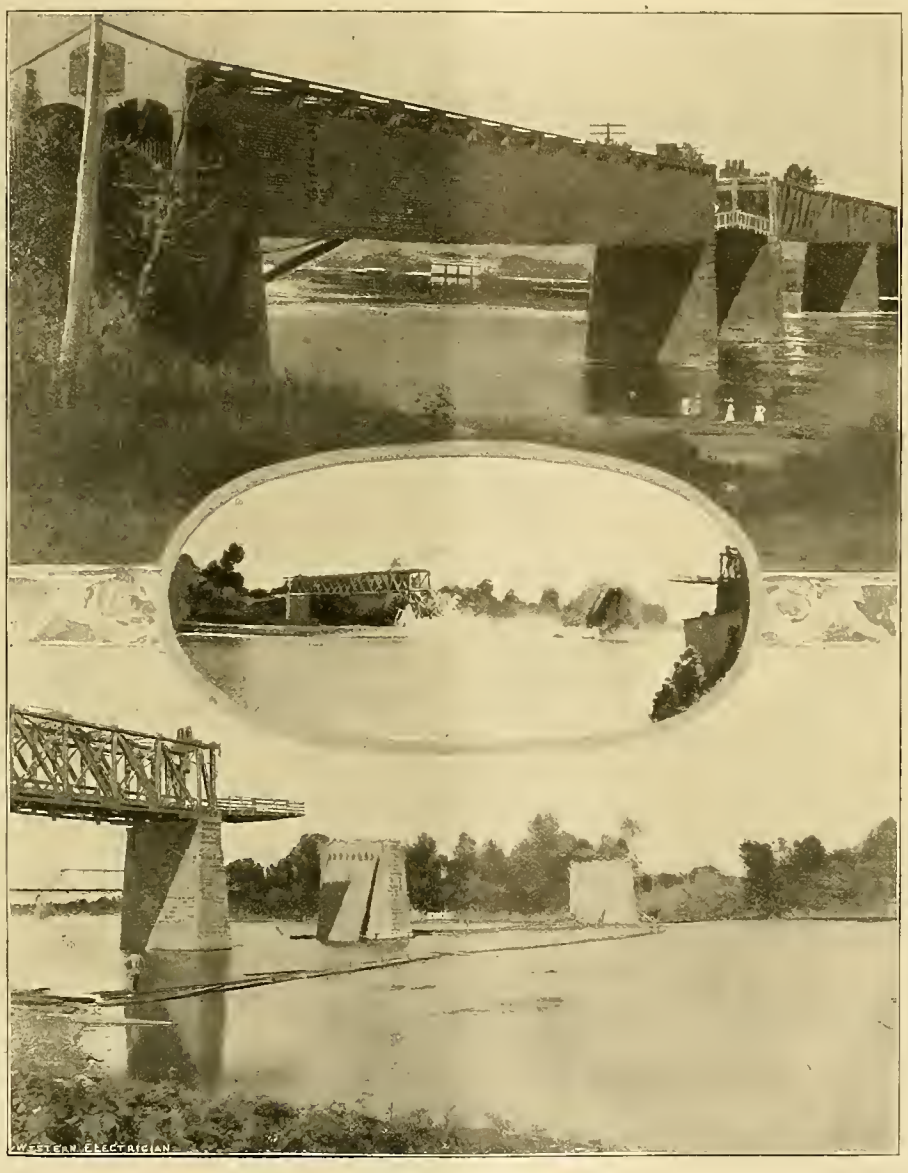
Each span of the bridge was composed of nine chords, each consisting of three timbers. Therefore, if these 27 sills were cut simultaneously the span would drop between the piers to the river beneath. This was what was actually done, the cutting being accomplished by burning through the wood by loops of iron resistance wire made red-hot by the passage of an electric current. The timbers were of yellow poplar and nine inches square. Each one was burned simultaneously in two places, about 10 feet from the pier at each end. Thus the mass of timbers dropped well inside the piers without injuring them.

By this method it was required that 54 resistance loops be heated to wreck each span. No. 12 iron wire was used for these loops, and over 100 feet of it was required. At the bottom of each loop a five-pound sash weight was fastened to an insulator. This weight pulled the loop down as it burned its way through the timber. Sufficient current was used to heat the iron wire cherry red. Alternating current at 50 volts' pressure was employed, and the distance of the farthest point of the temporary wiring to the shore connection was 650 feet. One span was wrecked at a time, and the time that elapsed from the moment of turning on the current until the fall of the span was one hour and 40 minutes in each case.

Examination after the fall of the bridge showed that all the sills were burned by the wire loops in exactly the same manner—five inches deep from the top and three inches deep on the sides. When this depth was reached the weight of the span fractured the remaining wood. The cut made by the hot wire was quite sharp and clean, and the wood was not charred more than an inch from the place of fracture.

Mr. Mills' plan was successful in every particular, and he was the recipient of many congratulations. The current was first turned on about five o'clock in the morning on the day of the wrecking, and at two o'clock in the afternoon the last span crashed to the river bed and a great shout of admiration went up from the throats of about 2,000 spectators who witnessed the feat.

In the group of illustrations the upper view shows the old bridge as it appeared before the wrecking. The smaller picture in the center is a reproduction of a snap-shot taken as the first span was falling, and the photograph reproduced in the lower illustration was taken immediately after two spans had been wrecked.



WRECKING A BRIDGE BY ELECTRICITY.

Processional Electric Balls.

In a note presented to the French Academy, some curious points relative to globular electricity are given. The writer says that when two metallic points, very fine and highly polished, each being in contact with the poles of an electrostatic machine, rest perpendicularly upon the sensitive surface of a photographic plate or gelatino-bromide of silver placed on metallic foil, the two points being five or 10 centimeters apart, there will be a visible flow of electricity around the positive pole, while at the negative there will be formed a luminous globe. When this has assumed sufficient dimensions it will detach itself from the point, which then loses its luminosity entirely, and move slowly along the plate, making detours, stopping, and again moving toward the positive pole. When it arrives at that point the two lights become extinct, and the machine now discharges as if the two poles were united by a conductor.

The speed of the processional globe is very deliberate. From one to four minutes are required to cover the distance of five to 10 centimeters. Sometimes in its progress it breaks into two or more luminous globules which march individually to the general rendezvous.

Developing the plate shows the route of each of the members of the procession, the place of the two poles, and, finally, if the experiment is stopped before its culmination, the track of the procession is only completed up to the point where the globules had arrived. The track of the globule becomes a conductor.

While the march is in progress if powdered sulphur is scattered on the plate the track is marked by a line of small aigrettes, having the appearance of a luminous chaplet.

M. Gustave Planté in 1878, exhibited before the Academy similar globules of electricity by the use of 800 couples of secondary cells. Du Moncel, writing of these experiments, and comparing their results with the ball electricity of nature, says:

"When we connect a battery of 200 couples with a voltmeter of acidulated or saline water, in such a manner as that the positive electrode is first immersed, the subsequent contact made by the negative wire at the surface of the liquid results in fusion and volatilization of the metal, accompanied by a flame, colored according to the nature of the electrode. Now, by weakening the solution in the voltmeter sufficiently to prevent fusing the electrode, there appears a continuous succession of sparks accompanied by a noisy crepitation, and these sparks will continue, through a gradual weakening of the liquid, for some minutes. But if the reverse of this method is practiced, bringing the negative first into the liquid, the phenomena are markedly different. The positive wire does not melt, but at the point of contact a luminous liquid globule will be formed, accompanied by a peculiar roaring sound.

By slowly raising the wire from the liquid the globule augments in volume as if there were an attraction exercised by the electrode, until the little ball acquires about a centimeter diameter, and assumes a rapid gyratory motion. The centrifugal force flattens the ball, which, if the other pole is brought near, reaches out as if attracted. If now the wire is plunged into the liquid the ball disappears simultaneously with the appearance of a bright spark at the negative terminal."

M. Planté says that the direction of the gyratory movement is not uniform, but is liable to change without apparent cause, and is attributable to the reaction due to escaping current, while the noise is that of condensing steam generated by the heat evolved. An intermittent sparking is attributable to the fact that as the globule reaches its greatest diameter the flattening due to the centrifugal force finally raises the globule far enough to break the contact with its lower surface, and thus stop the flow of current. This allows the fluid again to close the contact, when the same cycle of phenomena is presented. It thus becomes an interrupter, more or less rapid, according to the distance the terminal is raised from the electrolyte.

If in place of permitting the electrode to be fixed stationary, it be suspended from a considerable height as a pendulum, and so adjusted as to barely touch the fluid in its movements to and fro, and this be done in the dark, a very interesting result is obtained. The little balls of fire chase each other across the surface, back and forth unremittingly, while the pendulum is in motion; and the effect is still further heightened if little ripples be formed on the surface of the vessel containing the liquid.

Planté, by the aid of his rheostatic machine, was enabled to produce traveling globules which left their track plainly visible on a mica plate. "Nothing is more whimsical," says Planté, "than the movement of this little fire ball, slowly marching, and choosing its route according to the resistance of the isolated plate. The mica of a condenser was cut through the length of the traveled route, and the tinfoil formed a double chaplet of small grains melted at the edges of the consumed mica."

Electrically Operated Porous-plaster Factory.

In no branch of electrical activity has greater progress been made in the last six or seven years than in the employment of electric drive in manufacturing establishments. Early in the development of the art of electrical power transmission it was seen that the electrical system, with one central source of energy, transmission of power over easily disposed wires, and motors for individual machines or groups of machines, possessed many advantages of economy and convenience over scattered steam engines or long lines of shafting and belting. In large works the advantage of centralizing the power generation, obtaining the economy of large engines in one plant, and also the consequent saving in labor, was at once apparent. In smaller establishments the economy consisted in the fact that the power was used for each machine or group of machines only as needed; there were no long line shafts to be turned and to consume power without giving any useful return; the drop in the wires of the factory plant is negligible compared with the wastefulness of the line shaft, unless all the machines attached to the latter are alike continuously employed, which is infrequently the case in practice. Another distinct advantage of the electric drive is the saving in space and the superior cleanliness, light and ventilation made possible by the absence of the cumbersome overhead shafts and pulleys with ther flapping belts.

But for some time the progress in introducing electrical transmission in factory plants was slow. Owners and managers looked upon the new system with suspicion. The generators might break down, they said; the motors were unreliable; there was a distinct addition to the fire hazard. And in the early days, too, electrical machinery was expensive. To-day, however, thanks to the electrical engineer's improvement of the apparatus and to the energy of the electrical salesman, this antagonistic attitude is disappearing. The factory manager gives the electrical man a fair hearing, and each individual case is figured on a basis of dollars and cents, without the fear and prejudice of former days. The World's Fair, with its extensive electrical power transmission, did much for the electrical factory plant of to-day; and now the advantages of electric drive are found in machine shops and other metal-working establishments, sawmills and all kinds of wood-turning shops, cotton mills, bicycle factories, sewing-machine factories, printing establishments, breweries, watch factories, piano-making establishments, shoe and clothing factories, foundries and in many other industrial institutions. In many of these interesting and instructive motor applications have been evolved; and this is true in no small degree of the plant herewith illustrated, which is also probably the first electrically operated porous-plaster factory in the world.

This interesting installation is found in the new building belonging to Bauer & Black, at the southeast corner of Armour avenue and Twenty-fifth street, Chicago. It is a manufacturing establishment employing a varied assortment of machinery. Power is transmitted from the Harrison street station of the Chicago Edison company to rotary transformers located at its plant at No. 2640 Wabash avenue, and from that point is carried on three-wire mains to the curb wall of the factory building, the total length of conductors being over three miles. The service provides for about 43 constant-potential Bergmann arc lamps of 2,000 candle power each, 125 Edison 16 candle power incandescent lamps, and 35 220-volt Crocker-Wheeler motors, aggregating over 100 horse power. The entire electrical equipment, including wiring in iron-armored conduit, motors, incandescent and arc lamps, was installed by the Chicago Edison company, in accordance with the specifications of the architects, Holabird & Roche.

FIG. 1. ELECTRICALLY OPERATED POROUS-PLASTER FACTORY.—SMALL PRINTING-PRESSES DIRECTLY BELTED TO MOTORS.

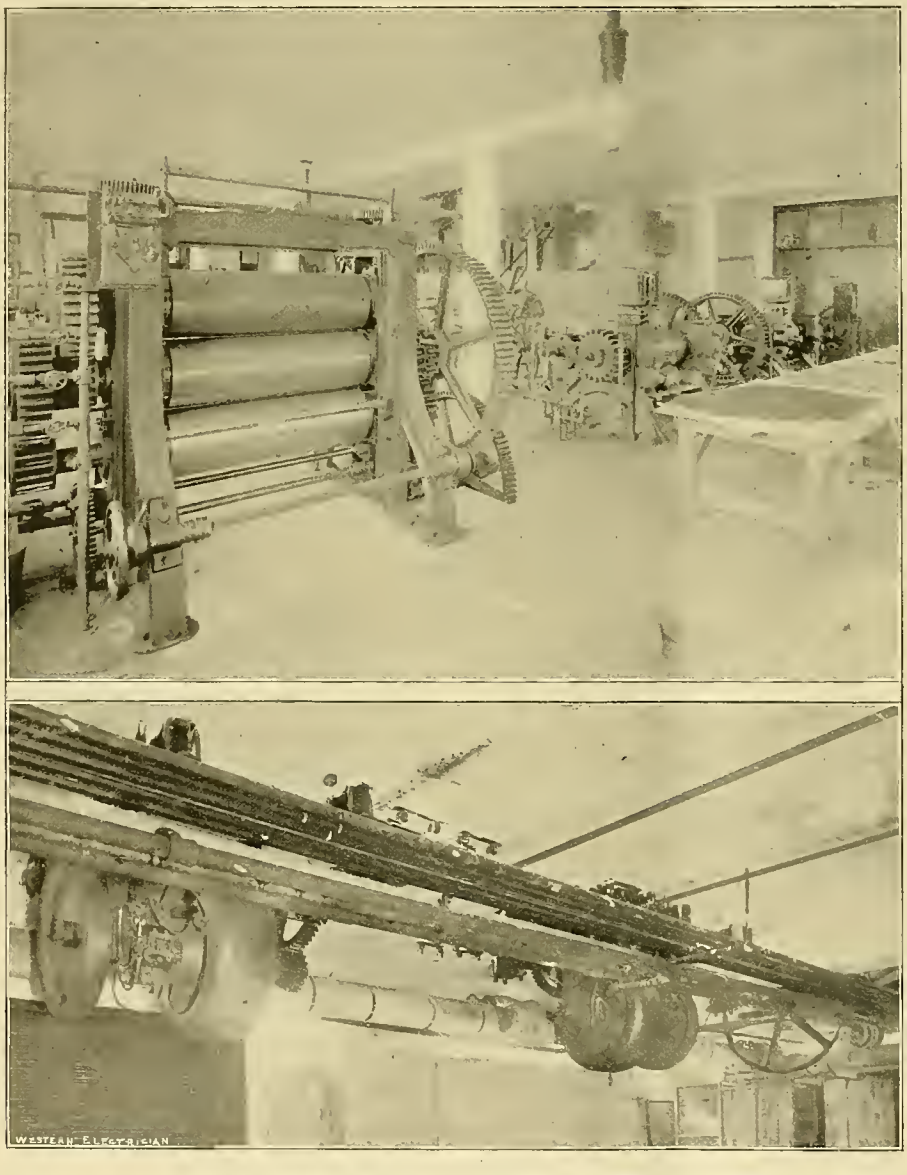


FIG. 2. ELECTRICALLY OPERATED POROUS-PLASTER FACTORY.—CALENDER, GRINDERS AND WASHER DIRECT-CONNECTED TO MOTORS IN BASEMENT.

On entering the building one is surprised to find the almost absolute cleanliness of every floor—a condition rarely found in the ordinary factory. Most of the machinery is located on the first and third floors, while the second floor is used for office, shipping room, etc. On the third floor there are about 80 sewing machines driven on two shafts by two two horse power motors geared directly to the shafts. There are also seven Gordon printing-presses, as shown in Fig. 1, six of these presses being driven by individual one-half horse power motors, each controlled by a starting box and switch located on the frame of the press and convenient to the operator. The seventh press is driven in the same manner by a one-fourth horse power motor. A fan and a churn, located on this floor, are driven by motors.

The first floor is divided into two parts, one devoted to machinery for the manufacture of porous plasters, and the other devoted to cotton machinery. The porous-plaster machinery is comparatively heavy, and consists of one 7½ horse power washer, two 12 horse power grinders and one five horse power calender. The washer takes the crude rubber, works it over and thoroughly cleanses it. This rubber is then sprinkled with the various ingredients required in the different plasters, and the combination is mixed between two powerful rollers in a machine called the "grinder." This rolling or mixing process calls for a very wide variation of power, the load on the motor varying between two and 20 horse power. The calender has three large, heavy rolls, which run at a speed of three revolutions a minute, and roll out the plaster in thin sheets on cloth ready for the perforating machine. These large machines are all located on the first floor, but are geared to motors which are fastened to the

ceiling of the basement. By this arrangement, which is indicated in Fig. 2, the gearing of the motors is entirely out of the way and the handling of the machines themselves is greatly facilitated. An idea of the tremendous pressure from these rollers may be inferred from the fact that the 12 horse power motors are geared down from about 800 revolutions a minute to a speed at the rolls of 12 revolutions a minute. As this class of machinery has never before been operated by motors, the owners had expressed some doubt as to the practicability of electric power for this particular purpose, since the conditions were so very exacting and severe. The result, however, the owners say, has been one of unqualified success.

One requirement for the grinders was the necessity of instantly stopping them at any time during the process of the operation. This result is accomplished by an ingenious arrangement, by which, when the motor is thrown off, the armature is short-circuited momentarily through a special resistance. The armature then acts exactly like that of a dynamo, and the current generated acts as a perfect brake on the machine. Thus, without taking any current from the line, the momentum of the motor produces its own brake and the machine stops almost instantly.

In Fig. 3 are shown the perforating machines. These machines are designed especially for this class of work, and they not only perforate the plaster, but also cover it with cloth and cut it off in the required lengths. There are only eight of these machines in existence—three of them being in this particular factory. As shown in the illustration, they are driven by one-half horse power motors located just beneath the machines.

On the other side of the first floor is another class of apparatus—the absorbent-cotton machinery. As this is the only plant of the kind in Chicago, it may not be out of place to describe briefly its operation.

The bale cotton as it comes from the South is first passed through what is known as the breaker lapper, which is shown at the right-hand side of Fig. 4. From here it passes through a number of tanks and is subjected to steam at high pressure until it is thoroughly cleaned. It is then put into a rotating machine (Fig. 5, p. 146), which is direct-connected to a five horse power motor. This machine revolves at a speed of 850 revolutions per minute, and the centrifugal action forces the water out of the cotton. This motor, as will be seen, has a vertical shaft, so that the armature is in an upright position. It is ordinarily covered with an iron case, which protects it from moisture, but this case has been removed for the purpose of illustration. From this rotary machine, called the "extractor," the cotton is taken to a steam dryer and then to the finisher lapper, which is shown on the left hand of Fig. 4, which further sifts out and refines the cotton.

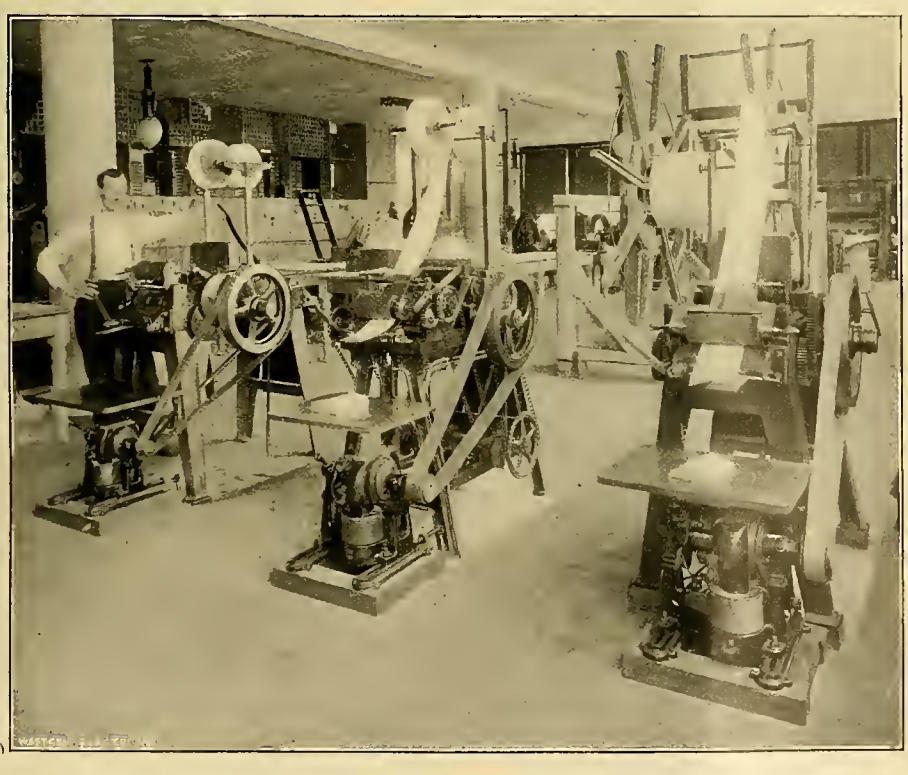


FIG. 3. ELECTRICALLY OPERATED POROUS-PLASTER FACTORY.—PERFORATING MACHINES.

Both the dryer and the lappers are driven from overhead motors suspended from the ceiling, as shown in the illustration. These motors are suspended on iron rails so arranged that they can slide backward or forward, just the same as if they were placed on the floor. From here the cotton is taken to the card machines, which are operated by motors below the floor. These machines carefully comb and card the cotton, which, at the end of this operation, is done up in white, fleecy rolls ready for the market. In Fig. 5 (page 146) may be seen a partial view of the card machines in the next room.

In addition to the special machinery above described, the elevator and pump installation is also driven by electric motors. Steam is supplied by two 100 horse power boilers in the basement, and is used for heating the building, for the special processes in the cleansing and preparation of the cotton, and for heating the rolls of the porous-plaster machinery. All of the machinery, however, throughout the building is run by electric power.

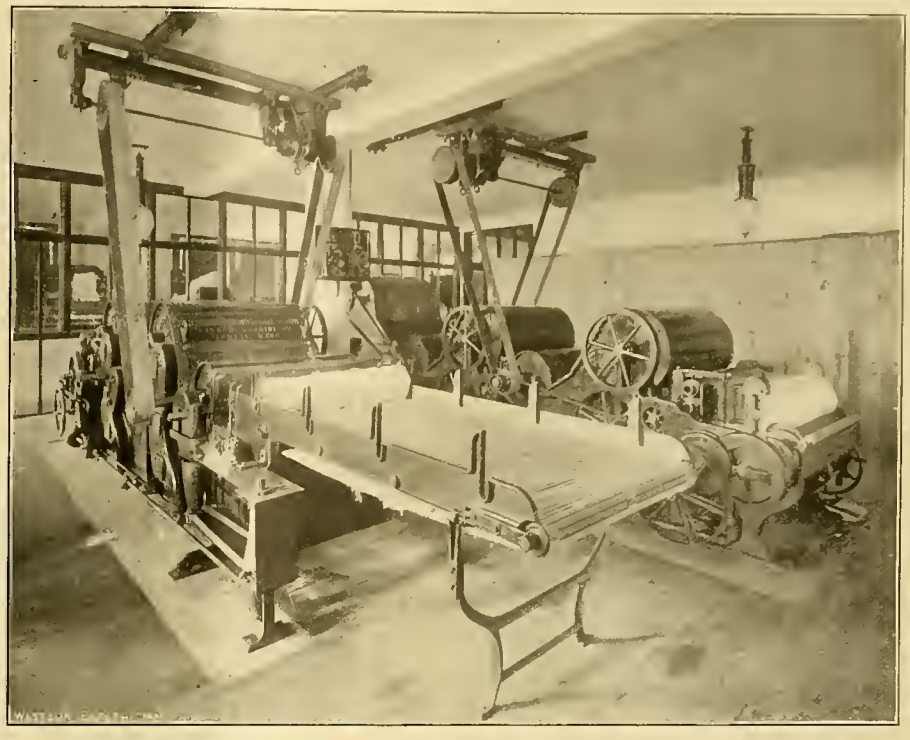


FIG. 4. ELECTRICALLY OPERATED POROUS-PLASTER FACTORY.—LAPPERS FOR PREPARATION OF COTTON.

In the operation of this plant it has been desired to secure perfect freedom from dust and dirt, as far as possible, and the use of electric motors seems to have solved this problem very successfully.

Bauer & Black express themselves as highly pleased with the substitution of electricity in place of the steam plant which they had in their old place on State street.

Work is rapidly progressing on the Toledo, Fremont and Norwalk electric railway that is building between Toledo and Norwalk, O., a distance of 65 miles.

Electric Street-car System of Hamburg.[1]

By Hugh Pitcairn.

The electric street-car system of Hamburg is claimed to be in every respect the best and most complete on the continent, exhibiting peculiar features, both in its construction and its management.

It is an especially interesting fact that the whole plant is the result of American invention, having been built after the Thomson-Houston system by the Union Electricity company for the joint-stock company called the "Hamburger Strasseneisenbahn Gesellschaft" (Hamburg Street Railway company).

Up to about four years ago, the old horse cars on some lines and small steam cars with trailers on others were the modes of street-car transit in this city, but the perfection of electrical locomotion and appliances caused an entire revolution.

The company was established with a capital stock of 21,000,000 marks ($4,904,000); its rolling material consists of 500 trolley cars and 400 smoking cars, hereafter described. The system is one of aerial electric current, the so-called "trolley-car system." It was with great difficulty that the wires could be strung, as on narrow streets and on those where traffic is extensive the state prohibited the company from setting up the poles. The company therefore had to make arrangements with the different owners of the houses on both sides of the streets, to obtain permission to anchor the cross wires to their walls, to which there could be raised no objection, as it was safe and obviated the presence of poles on the sidewalk. To obtain this permission, the company paid to house owners the amount of the cost price of the poles—47 marks ($11.20) for a one-wire-current anchor and 63 marks ($15) for a two-wire-current anchor. Wherever the poles are set up, they are of very neat appearance, and serve not only as poles for electric street-car wires, but also as electric-light poles.

In some instances the streets proved to be too narrow to lay a double track, and in order not to diminish the strength of the current a double contact wire was strung.

Some 10 years ago, before the electric street-car system was planned, the state of Hamburg had granted a monopoly of electrical appliances and currents on the public roads to the Hamburg Electricity Works. When the shareholders of the present electric street-car company resolved to build the road, and also to build their own electrical plant, the Hamburg Electricity Works insisted upon its rights, as the only body entitled to build or use electrical appliances or currents on the public roads of the city of Hamburg, although at the time the monopoly was granted to the said works nobody ever thought of trolley cars, but simply of "electric lights on public roads." However, the contract reads "electric currents," and not "electric currents for electric lighting." The Hamburg Electricity Works, therefore, was greatly in the way of the newly planned trolley-car system. However, a satisfactory arrangement was made between the street-car company and the electricity works, in that the latter enlarged its plant in order to supply to the street-car company the electricity required to move 500 trolley cars (or large cars) and 400 trailers (or small cars), called "smoking cars." These smok-

1. United States Consular Report. Mr. Pitcairn is the consul at Hamburg.

ing cars are simply the old horse cars and are coupled to the trolley car by means of a link or connecting rod; thus, the old equipment is utilized. About every third trolley has one of these trailers or smoking cars.

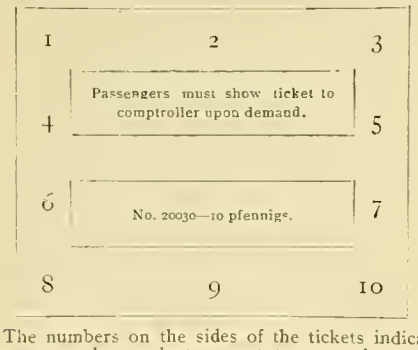
The Hamburg Electricity Works pays to the state of Hamburg 20 per cent. of its gross income, as a return for the monopoly; the street-car company pays for the electric current 12½ pfennigs (equal to 2.97⅙ cents) per kilowatt. The state of Hamburg refunds to the Electric Street-car company 20 per cent. of this price, leaving a net cost price for the electric current of 10 pfennigs (2.38 cents) per kilowatt.

As a compensation for the use of the public roads the street-car company pays to the state of Ham-

FIG. 5. ELECTRICALLY OPERATED POROUS-PLASTER FACTORY.—EXTRACTOR, WITH MOTOR ON VERTICAL SHAFT.

burg one pfennig (0.238 cent) for each passenger. The average fare for each person carried being 11.5 pfennigs (2.74 cents), the state receives 8.7 per cent. of the gross income of the company. In addition to this, the street-car company must keep the paving inside of the tracks and 30 centimeters (11.8 inches) outside of each track in proper condition.

The fares on the Hamburg trolley cars are exceedingly low. After long experimenting, the "tariff of distances" was found to be the better plan, and was approved by the Senate. It might be mentioned here that the street-car company is not at liberty to fix the price of the fare on its lines, but must forward passengers at the rate fixed by the Board of Public Traffic, to be approved by the Senate. All lines are divided into zones of 2,000 meters (1.24 miles), and the fare is as follows: For the first two zones (4,000 meters, or 2.48 miles), 10 pfennigs (2.38 cents); for each two zones or part thereof, thereafter, five pfennigs (1.19 cents). Each passenger, upon payment of the fare, receives from the conductor a ticket, which is cut of from a long roll of tickets, each ticket being provided with a number. The tickets have different colors—yellow for the 10-pfennig or two-zone distance; green for the 15-pfennig or four-zone distance; blue for the 20-pfennig or six-zone distance, etc. The following is a drawing of a ticket, four times enlarged, showing the controlling number and other controlling marks, hereafter described:



The numbers on the sides of the tickets indicate the zones; the conductor must tear out that zone number at which the passengers step on the car. In this way it is impossible for passengers to commit fraud by buying a two-zone ticket, for a four-zone trip, etc., as it can at once be seen where they stepped on the car, and an attempt to deceive can be detected. When the conductor collects the fare, it is his duty to inquire the destination of the passenger, so that he knows exactly whether a 10, a 15 or a 20-pfennig ticket should be given. At the end of each two zones the conductor fills in a blank form, and states the last number of each grade of ticket sold. If a comptroller steps on the car (and he is liable to step on at any time) he simply counts the number of passengers, which must also be the total number of tickets sold; if there is a discrepancy, it proves that either there is a passenger on the car who has not paid, or that the conductor has collected the money, but neglected to give out a ticket. The passengers are then requested to show their tickets; the passenger having no ticket (whether he says he has paid his fare or not) must pay again, and the conductor is fined one mark (24 cents) for the first offense, three marks (72 cents) for the second, and discharged at once when the third offense is detected.

The commutation-ticket system is a peculiar feature. The street-car company, acknowledging the fact that hundreds of people are bound to use the cars a dozen or more times a day, has issued "commutation tickets," divided in two sections. The first section entitles the holder of a commutation ticket to the use of one line in both directions, and as many times as he chooses, including Sundays. The second section issues commutation tickets for the use of all lines, in all directions, and allows the holder to avail himself of the accommodations as many times as he chooses. These tickets are valid from three to 12 months, and the prices are so low that if a person uses the cars over three times a day a commutation means a saving—in some cases the fare for each trip amounting to less than one cent.

Prices for commutation tickets are as follows:

Duration of ticket.	For use on one line.		For use on all lines.	
	Marks.		Marks.	
Three months	25.00	$ 5.95	46.50	$11.07
Four months	32.00	7.62	60.00	14.28
Five months	39.00	9.28	73.00	17 37
Six months	46.00	10 95	86.00	20.47
Seven months	52.00	12.38	98.00	23 32
Eight months	58.00	13.80	109.00	25.94
Nine months	64.00	15.23	120.00	28.56
Ten months	69.50	16.54	130.00	30.94
Eleven months	75 00	17.85	140.00	33.32
Twelve months	80.00	19.04	150.00	35.70

In addition to this, combination tickets may be had for the use of one specified line and part of one other line, and, also in this instance, prices are extremely low. Further, very cheap tickets are issued for children going to school. These tickets are personal, a trip costing about four pfennigs (0.95 cent).

The cars stop only at fixed halting places to take on and let off passengers. These halting places are generally at street crossings, marked by a white sign affixed to lantern poles, on which is printed the word "haltestelle" (halting place).

The trolley cars offer seats for 20 to 28 persons, 10 to 14 on each side. Besides, four persons are allowed on the front and five persons on the back platform. The full number of passengers being on the car, the conductor lowers a sign, "Besetzt," which means "occupied," and a car cannot take more passengers than the above number. The regulations in this respect are very strictly observed. Say, for instance, a lady steps on the car at a halting place, while the conductor is front, collecting fares, the car being already "occupied" when the lady stepped in; but there being no conductor to prevent, she goes inside, and a gentleman offers her his seat, the gentleman then taking a stand on the platform. The conductor returns to his post, when the gentleman is requested to step off the car at the next halting place, having forfeited his seat and the car being fully occupied. Should he refuse to leave the car, he is put off. The policemen on the streets have instructions to watch the cars sharply when passing their post; and if they detect a car carrying one person more than the fixed number, the policemen note the number of the car, and the company receives word that the said conductor has been fined three marks (72 cents), to be deducted from his wages and to be paid to the police board. If a comptroller of the company steps on the car and detects a surplus of passengers, he notes the number of the conductor, who is fined three marks (72 cents), which are paid to a charity fund and divided once a year to employes of the company requiring support.

All cars—not only the trolley cars, but also the smokers—are supplied with hand and electro-magnetic brakes; the latter are applied in case of danger, and afford a sudden halting of the car. There are no fenders in use on the cars, but accidents are few. Experiments are being daily made with all sorts of safety appliances to test their reliability; but up to the present the company has not decided to introduce any particular system on all cars. There is certainly an opportunity here for a good American device, as the different appliances now in use are not fully satisfactory to the company or to the authorities.

The Hamburg Electric Street-car company must be considered a model institution and its system worthy of careful study.

Canadian Water-power Development.

For over a year the scheme of utilizing the water power of the St. John River at Grand Falls, N. B., for the purpose of generating electricity, has been in contemplation. Among those interested in the scheme are Sir William Van Horne and Senator Proctor of Vermont. Recently Senator Proctor met the council of Grand Falls. He wished a lease of the commons, a tract of land granted the town of Grand Falls in the days of King George III., and which the town can lease, but cannot sell. The council informed the senator that they would give his company a lease if he would guarantee an expenditure of $250,000 within 18 months. The senator, it is reported, was favorable to this argument, and as a result engineers are now making surveys.

T. Pringle & Son, hydraulic and mechanical engineers of Montreal, have been awarded the contract for the erection of large electrical works at Chaudiere, which is located some six miles from Levis, Que. The idea is to furnish light and electrical power to the city of Levis and the smaller places in the immediate neighborhood. The company is known as the Canadian Electric Light company of Levis. The necessary power will be obtained by damming the the Chaudiere River. From this dam will extend three pipes of immense size, each being eight feet three inches in diameter, to a site 800 feet below, where the power house will be constructed. This will give a drop of 114 feet, and the power generated in this way will be equal to 6,000 horse power.

FIG. 2. TRANSMITTING PICTURES BY ELECTRICITY.—THE ORIGINAL AND THE PICTURE RECEIVED.

The dam on the Chaudiere will extend straight across, a distance of about 1,000 feet. Six double turbines of about 1,400 horse power each will be installed, and the current will be generated by six two-phase dynamos of 1,000 horse power each. Work upon the plant will be begun at once, and it is expected that it will be completed and ready for operation in the spring. This will be the first electrical power plant for the city of Levis.

It is difficult to realize the changes made in the neighborhood of Shawinigan Falls, on the St. Lawrence River, since the Shawinigan Water and Power company began the development of the water power at that place—a development which, it is said, will eventually be carried out to the extent of 150,000 horse power. The Shawinigan company, which has a capital of $6,000,000, first had to provide means of communication with the outside world, and this was done by building a branch railway 4½ miles long, to connect with the Great Northern railway. This gives a direct route to Quebec, and Montreal is reached by the branch of the Canadian Pacific railway, running down to Three Rivers. The Shawinigan company bought not only the water-power

rights from the government, but also 800 acres of land immediately adjoining that which it is now surveying and laying out into town lots, etc. The company, some months ago, gave to the Warren-Scharf company of New York the contract for a canal, bulkheads, power house, etc., and it is expected that this work will be completed by January next, when the necessary dynamos and other electrical machinery will be at once installed for the production of 50,000 horse power. This will make it the largest power plant in Canada, and one of the largest in the world, and it can be increased to the limit available, 150,000, as the power may be required.

Meanwhile the Shawinigan company has been busy disposing of its wares; that is to say, the power it is developing, and has already made contracts of the sale of an amount of power which puts it immediately in the front rank of the greatest power companies of the world. Among the enterprises which will locate there is the Canadian Carbide company, which has contracted for the use of 10,000 horse power. It comprises Sir William Van Horne of Montreal, William McKenzie of Toronto, James Sutherland, M. P., of Woodstock, Ont., and other well-known capitalists. With an almost unlimited supply of the materials for manufacturing calcium carbide, electricity, limestone and charcoal, and through the patents which it controls, this company will be in a position to dominate the whole market for this product. The Shawinigan company has also made a contract for the sale of 10,000 horse power to the Pittsburg Reduction company, which will install a plant for the manufacture of aluminum on a large scale. This latter company, which has a capital of $1,600,000, will be the first to manufacture aluminum in Canada, and will employ between 400 and 500 men. Other large contracts for the use of power have also been made.

The statement recently made that the Royal Electric company of Montreal had been awarded the contract for installing machinery for the development of power at Ragged Rapids and its transmission to Orillia, Ont., seems to be incorrect. Mr. F. Strickland, superintendent for the Electrical Maintenance and Construction company of Toronto, now states that the latter company has been awarded the whole contract, including the construction of a power house at Ragged Rapids, dams and machinery and overhead wires. Mr. Strickland says that this is the first instance in Canada where a municipality has undertaken to develop and transmit electric energy such a long distance, the rapids being 20 miles from Orillia. The Toronto company has undertaken to put in plant capable of developing 5,000 horse power for supplying light, heat and power to the whole town of Orillia by December 1st next. The work was at first intrusted to a Buffalo firm, which subsequently backed out, and the contract was then given to the Toronto company at an advance in price. The contract price is $71,000. W.

Fireman Shocked Through Metal Helmet.

John J. Evans, a captain of one of the fire-engine companies of Chicago, recently received a 500-volt shock while performing his duties at a fire. He wore an aluminum helmet, and as he was leading a squad of men up a stairway his helmet came in contact with a live wire which was attached to the dynamo that ran the elevator and which had fallen across the stairway. As he was standing in water, a good circuit was made and he received a severe shock; but beyond a few slight injuries received in falling down the stairs the man was not injured.

The New York Herald and the Chicago Times-Herald announce that they have made arrangements with the management of the ocean-going steamer La Grande Duchesse to report from its decks, by space telegraphy, the international races between the yachts Columbia and Shamrock, that are to take place next month. It is said that the facilities offered by this steamer to carry out the work successfully are excellent. The steamer will be present at all the international yacht races, and it is expected that every incident of the races will be quickly dispatched. The success of this event will be watched with interest, as it will be the first attempt on this side of the Atlantic to use the Marconi system in obtaining reports of a great event.

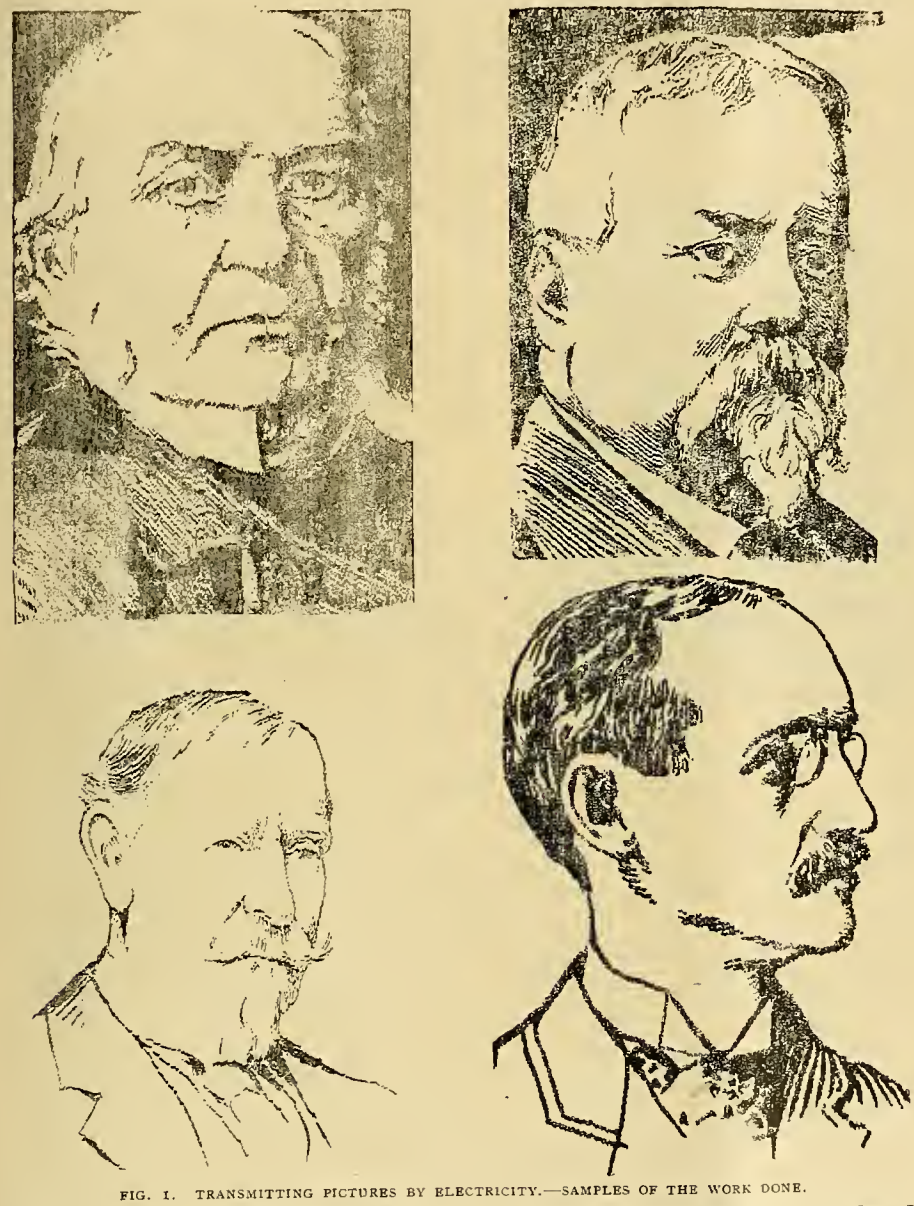


FIG. 1. TRANSMITTING PICTURES BY ELECTRICITY.—SAMPLES OF THE WORK DONE.

Transmitting Pictures by Electricity.

For the last eight or 10 years, at least, inventors have been working on the problem of transmitting pictures and drawings by electricity, and results have been achieved which are very encouraging. Some of the most recent work accomplished is reproduced in the accompanying illustrations. Four portraits are shown in the group in Fig. 1. These pictures are reproduced from the copy made by the receiving machine and are not retouched in any way, rather losing something in sharpness and detail through the photo-etching process. The pictures were transmitted this summer between Cleveland and St. Louis over a Western Union wire measuring about five ohms to the mile, the total distance, by wire, between sending and receiving points being about 650 miles. Readers of the Western Electrician should have little difficulty in recognizing some or all the portraits, but if a key is wanted it may be stated that the pictures represent Gladstone, Admiral Schley, General Fitzhugh Lee and Mr. M. E. Stone, the general manager of the Associated Press.

In Fig. 2 the transmitted portrait is placed beside the original photograph, for comparison. This picture was also transmitted over the 650-mile circuit between Cleveland and St. Louis. It represents Mr. J. C. Barclay, the electrician of the western division of the Western Union Telegraph company, who is much interested in the experiments.

The pictures shown herewith were transmitted by the Dun Lany machines, which are being developed by the International Facsimilegraph company of Cleveland, and in which the managers of the Associated Press take an interest, as the invention, if perfected, will be of much value to newspapers. Patents are being taken out in all the more important countries. One patent, for a "facsimile telegraph," was issued by the United States to William P. Dun Lany and Thomas Mills on August 22d and assigned to the company mentioned.

In transmitting a picture or drawing, it is first stereotyped on a flexible metal plate. The outlines of the picture are exposed, while the remainder of the surface of the plate is covered with a non-conductive paint. The plate is then placed around a brass cylinder five inches long and two inches in diameter and the machine, which is operated by an electric motor, is started. An arm bearing a tracer has its base upon a very finely threaded rod and gradually moves to the left, until the entire picture has been covered by the tracer. Both sending and receiving machines are governed by a simple synchronizing arrangement, so that both machines are regulated in their speed automatically and must run exactly together. The tracer at the sending point controls the current on the wire and closes the circuit whenever it comes in contact with the exposed lines of the picture.

At the receiving end the apparatus is similar to that at the transmitting point. The projecting arm over the cylinder, however, is provided with a stylus controlled by an ordinary telegraph sounder. Around the cylinder is wrapped several sheets of paper with carbon copying sheets between them. The sounder bearing the stylus closes down on the cylinder and copying paper, recording the most minute lines in the original picture, as the tracer at the sending point passes over them.

In transmitting written or printed matter the process is the same, except that the copy is either written or copied on a flexible brass or metal plate, the circuit being broken whenever the tracer strikes the ink, which is non-conductive. In this case the receiving instrument is reversed, so that it records on the paper the opening instead of the closing of the circuit. The synchronizing arrangement, which is perhaps the most important feature of the invention, is most ingenious and is arranged so that, no matter how many receiving machines there may be cut in along the line, it is not necessary to have an operator or attendant to care for them. It is said that the operator at the transmitting point can easily correct or regulate the speed of all.

It is claimed that by using an enlarged cylinder, a half or even a full newspaper page, in matrix form, can be placed in a transmitting machine, operated, say, in New York or Chicago, and reproduced simultaneously in practically all of the leading cities of the country within a very few minutes.

Electric Fans in the Orient.

In the Orient the American electric fan is superseding to some extent the ancient punka, being welcomed by everybody except the punka workers, whom it threatens to throw out of employment. As soon as the market was discovered Germany appeared in the field as our competitor, says the New York Tribune, cutting prices and adopting other expedients to push her wares; but the American machine was found the best, and is the one most in favor. The rajah of Koti has mounted one on his throne, and is so much pleased with it that he has ordered $30,000 worth of fans for distribution in his dominions and as presents to other rajahs. Japan is also a liberal buyer, and the fans are beginning to be introduced into China.

It is said that, with the exception of steel rails, the iron and steel mills of the country are now so busy that they cannot accept large orders, unless for delivery next year.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

New York State Street Railway association, Ithaca, September 12th and 13th.

Association of Edison Illuminating Companies, Philadelphia, September 12th to 14th.

Old-time Telegraphers' association and United States Military Telegraph Corps, Copley Square Hotel, Boston, September 12th to 14th.

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

Pennsylvania Street Railway association, Stevens House, Lancaster, Pa., October 4th and 5th.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

An ingenious application of electricity was made in the recent wrecking of a wooden bridge at Clinton, Md., described on another page. By the use of loops of wire heated red-hot by resistance to the passage of a current of electricity, the sills supporting each span of the bridge were burned off simultaneously. The advantages of the use of electric heat were that it was confined exactly where it was wanted and that each of 27 timbers was burned in two places simultaneously, cutting out the span sharp and clean. The use of electricity saved much time and money and extricated the owner of the bridge from a dilemma in which he became involved by a promise to wreck the bridge, without injuring the piers, within a 30-day period. Mr. Mills, the electrician in charge, deserves much credit for the successful accomplishment of a novel bit of work.

While the danger from the electrolysis of buried metal pipes by stray electric currents has been greatly overrated by many persons and newspapers, it is a serious evil in some localities. One man goes so far as to propose that all water and gas pipes shall be made of glass or some vitreous composition. This remedy will hardly be adopted, as, with improved methods of providing a return path for the current to the power house, we shall hear less of the cause of the damage, until it becomes so slight as to excite no serious apprehension. Nevertheless, it is interesting to note the suggestion, derived from the experience of St. John, N. B., that pine plugs be used to make the joints of water pipes instead of melted lead. It is said that the experiment has been successful in St. John, and that the method is not only more economical than lead joints, but that it promises to work out to considerable advantage in the insulation of the sections of pipe.

New Yorkers seem to be somewhat exercised over the possible dangers of the third-rail system for elevated railroads now being installed in Brooklyn. They will find in practice, judging from the experience of Chicago, that accidents will be few and far between. Under all ordinary circumstances no person is allowed on the structure save experienced employes, who realize the danger fully and know how to avoid the contact rail without difficulty. In the rare case when a train is stalled, and it is necessary for passengers to walk on the elevated structure to the nearest station, it is easy to provide a temporary insulated pathway well over the third-rail at the point where a crossing is made, or, better still, the current may be cut off from that section of the road for five minutes until the passengers are safely transferred. In Chicago there is a good board walk over the feeders between the tracks; and to any person with a cool head and a knowledge of the position and characteristics of the third-rail the danger is very slight; it is only necessary, in crossing the tracks, to step carefully over the contact rails and not on them. However, only employes should be allowed on the track structure unless in emergency, and then it is best to switch the current off.

The National Export Exposition, which will be opened in Philadelphia on Thursday of next week, continuing until November 30th, is an enterprise of much concern to all American manufacturers who are engaged in the export trade, who are about to engage in it, or who would do so were they not deterred by the difficulties of satisfying customers, extending credits and making collections among peoples of varying language and customs 10,000 miles away. The exposition is designed as a complete display of American manufactures and products suitable for export, planned particularly for the benefit of many delegates, commissioners and merchants who will come from every part of the world to attend the International Commercial Congress. There will also be a department of samples of manufactured goods made abroad and now sold in foreign markets. Thus visitors will have an opportunity to make direct comparison of goods of American and European manufacture.

The International Commercial Congress mentioned will be most important. It will be convened in the auditorium of the exposition on October 10th and will be made up of accredited representatives of the leading governments and chambers of commerce of the world—an international gathering of practical businessmen. The Congress will devote itself to a discussion of the world's trade by men directly interested. It is expected that the president of the United States will welcome the delegates and deliver the opening address. Thereafter there will be every opportunity for a full and fair discussion of all topics affecting international trade. Such practical subjects as tariffs, bounties, commercial education, international classification of commercial statistics, arbitration for the settlement of international trade disputes, sample warehouses, the metric system, parcels posts, interoceanic canals, advantages of an international currency, credit systems and the need of international laws concerning bankruptcies, patents and trademarks are listed for consideration.

The deliberations of this body should have an important effect on the foreign trade of the United States and other countries. Its educational features will be especially valuable in this country, where more than one manufacturer has retired from the export trade after some unfortunate experience, in Russia or South America, say, by which it seemed to be shown that the trouble of enlightening the foreigners and getting one's money from them was not worth what it cost. Intelligent, patient, persistent effort to extend the export trade of the United States is undoubtedly worth while, and we shall expect to know better how to direct that effort as one result of the International Commercial Congress.

Railroad men exhibit much interest in the possibility of making a more extended use of the telephone for train dispatching. The Railroad Gazette, from which an article on the subject by Mr. G. W. Blodgett was lately reprinted in the Western Electrician, has printed several communications on the subject. Mr. Blodgett advocated the use of the telephone and outlined a plan by which a record of messages could be kept and by which it might be assured that train orders were received precisely as sent. A Chicago correspondent rather takes Mr. Blodgett to task and says that while the telephone would save some time, the advantages of the method proposed are not as great as the writer of the first article seems to think. This critic concludes by saying: "The main point I would make is that to insure the necessary safety in the handling of train orders, under the present American dispatching system, every order must be put in writing; and, the average penman being able to write no faster than the average Morse telegraph operator, there is no advantage in sending messages any faster than they are sent now."

On the other side, Mr. C. A. Hammond supports Mr. Blodgett's position, so that the out-and-out telephone advocates are in the majority. Mr. Hammond speaks by the light of personal experience. While superintendent of the Boston, Revere Beach and Lynn railroad, he devised a system of telephoning train orders, and he grew to have the greatest confidence in it. No accident ever attended the use of this telephone system, and Mr. Hammond cannot remember a mistake in transmission, after the "O. K." had been given, in any essential particular. This writer found the superior quickness of the telephone invaluable and dwells on the advantage of rapid question and answer to explain a situation at one end of the wire to a dispatcher or superintendent at the other. "With the introduction of the metallic circuit and improvements in the transmitter," says Mr. Hammond, "the telephone service, with reasonable care in maintenance, became almost ideally perfect. Dictation and repetition were under practically the same conditions as if the two persons—sender and receiver—were both in the same room. * * * * Not only was the system of giving train orders by telephone satisfactory to the superintendent, in its practical working, but—what was of equal importance—the employes themselves, especially those whose duties were affected by it, had implicit confidence in it." Not infrequently the whole road was run by telephone with entirely successful results. Mr. Hammond details his system of telephone train orders and evidently believes in the instrument thoroughly.

There seems to be ground for the belief that one of the coming extensions of the telephone field is in railroad operation; and telephone men will do well to give this probable development their careful attention.

MUNICIPAL ELECTRICIANS

Welcomed to Wilmington at the Opening of the Exhibition.

[Special dispatch to the Western Electrician.]

Wilmington, Del., September 4.—What may safely be pronounced to be the most successful convention of the National Association of Municipal Electricians commenced with the gathering today at the convention headquarters, the Clayton House, of the members of the committee appointed to meet Governor Ebe W. Tunnell and Mr. J. H. Hughes, the secretary of state of Delaware, who arrived at 5 p. m. The committee was composed of Jonathan W. Aydon, president of the association; Mayor John C. Fahey; M. P. Satterthwaite, vice-president of the Board of Trade; A. S. Reed, chairman of the reception committee; George B. Moore, chairman of the ladies' reception committee; Josiah Marvel; Col. Enoch Moore; James Kane, chairman of the City Council committee; Col. R. H. Taylor and Adjutant-general Garrett J. Hart. At five o'clock the waiting gentlemen met the governor and escorted him to the Clayton House. Afterward the committee met the New York delegation, with special parlor street-cars for the ladies.

At half-past seven in the evening Mayor Fahey introduced the governor in an appropriate speech. Governor Tunnell then formally opened the electrical exhibition at Pyle's Academy given in conjunction with the convention. The affair was a marked success socially as well as in every other way. Many ladies were in attendance, and their attractive costumes, contrasted with the black evening dress of the gentlemen, formed a pleasing scene. The streets were especially illuminated; signs of "Welcome" were frequently displayed; visitors were given the freedom of the city and unlimited use of the street-car service. In every way the opening was most auspicious. F. L. P.

American Street Railway Association.

Preparations are now well under way for the eighteenth annual meeting of the American Street Railway association, which will be held at Tattersalls', State and Sixteenth streets, Chicago, October 17th, 18th, 19th and 20th. Papers will be read on subjects named as follows: "Maintenance of Car Equipment;" "Modern Street-railway Shops, Their Design, Machinery and Shop Practice;" "Train Service and Its Practical Application;" "Investments in Street Railways—How Can They be Made Secure and Remunerative?" "Construction and Maintenance of Street-railway Tracks."

A large exhibition of street-railway supplies is assured, Secretary Penington reporting that every foot of space in the hall has been applied for. At a meeting of the executive committee held in Chicago last February, the following resolution was adopted:

Resolved, That the last day of the convention, Friday, October 20th, be set apart for the systematic and careful inspection of exhibits by the delegates, and that all street-railway managers be urged to send delegations from their mechanical, operating and accounting departments to inspect the same.

The annual banquet will be held Friday evening, when the officers-elect will be installed.

The headquarters of the association will be at the Auditorium Annex. Railroad rates will be as before, one and one-third fare for the round trip on the certificate plan.

Commonwealth Station Criticized.

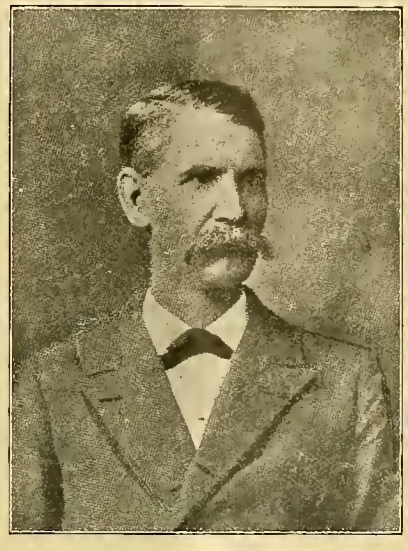
The Commonwealth Electric company of Chicago operates a central station of about 1,800 horse power capacity at the corner of Fifty-sixth and Wallace streets. The plant has been in use for about five years. Recently a number of citizens in the neighborhood of the plant, headed by an attorney, Henry M. Coburn, have instituted proceedings against the company and its employes, claiming that the smoke ordinance was being violated, that the company was maintaining a public nuisance, and that the health and happiness of the people residing in the vicinity were menaced. On September 4th the complainants caused the arrest of all the employes at the station. The company claims to be operating its plant entirely within the laws and under the ordinances of Chicago, having in use all the latest appliances, such as smoke consumers, automatic stokers, etc. Over 600 arc lamps are supplied from this station for the use of the city and the park commissioners. Besides this power is supplied for government and private uses. The company is now engaged in reconstructing the power plant and making additions which, when completed, will give the station a capacity of from 3,000 to 4,000 horse power.

At a recent election in Durant, Miss., $10,000 worth of electric-light bonds were voted.

New General Manager for the Chicago City Railway Company.

Since the late M. K. Bowen was advanced to the position of president of the Chicago City Railway company a year and a half ago, there has been no general manager for the system. Now the position has been revived, and Capt. Robert McCulloch has been appointed to fill it. Mr. George O. Nagle, the active and efficient superintendent, becomes assistant general manager by the new arrangement, and Mr. C. M. Duffy, formerly secretary and treasurer of the National Railway company of St. Louis, is made auditor.

Robert McCulloch is an ex-president of the American Street Railway association and a very well-known street-railway man. For 28 years he was identified with the street-railway systems of St. Louis, where he was intimately associated with Mr. D. G. Hamilton, now president of the Chicago City company. Captain McCulloch is of Scotch descent and a native of Virginia. He was educated at the Virginia Military Institution at Lexington, Va. He went as a cadet into the Confederate service in April, 1861, and followed General Lee until his surrender in April, 1865. He took up his residence in St. Louis in 1869, and in 1871 entered the service of the Bellefontaine Railway company of that city as superintendent. He was afterward made secretary, and then vice-president and general manager of the company. He continued in that service until 1889, when Mr. Hamilton and his



ROBERT M'CULLOCH.

friends purchased the Citizens', St. Louis, Cass Avenue, Northern Central and Union lines, and Captain McCulloch was made vice-president and general manager of these roads, which were operated by the National Railway company. In 1896-97 Captain McCulloch served as president of the American Street Railway association. Early in 1899 practically all the St. Louis railroads were amalgamated under the head of the United Railways company, Captain McCulloch being retained as division superintendent of the lines, and he continued in that capacity until September 1st, when his term with the Chicago City road began. Captain McCulloch is married and has three children, one of whom, Richard McCulloch, is a civil and electrical engineer in Vienna.

On the occasion of his resignation from the United Railways company, Captain McCulloch gave a farewell dinner at the Southern Hotel, St. Louis, on August 19th, to about a dozen of his old associates. It is expected that the new general manager of the Chicago City company will relieve the president's office of much of its work, having charge of the operating department of the system.

Large Verdict for X-ray Injury Reduced.

In the case of Frank V. Balling against Dr. Otto L. Schmidt and W. C. Fuchs of Chicago, in which the plaintiff was awarded a verdict of $10,000 for injuries resulting from an X-ray burn, Judge Chetlain has refused to grant a new trial, but entered judgment reducing the amount of damages from $10,000 to $7,000. The defendants refused to acquiesce in the amended judgment, however, and have appealed from the decision. This famous case was reported at some length in the Western Electrician of May 6, 1899. The trial lasted 10 days and was hotly contested. Mr. Balling lost his leg through injuries which he attributed to the use of the X-ray in an endeavor to ascertain the extent of injuries to a fractured ankle. The exposures were from 30 to 45 minutes' duration, made in the early days of the art of skiagraphy, and it was contended that the deep burns made several amputations necessary. The expert testimony was conflicting, and the jury gave the plaintiff a verdict for $10,000.

Mineral Production of 1898.

A "Summary of the Mineral Production of the United States in 1898" has been issued by the Division of Mineral Resources (of which David T. Day is the chief) of the United States Geological Survey. It is shown that since 1880 the total value of the mineral production of the United States has increased from $369,319,000 to $697,880,002 in 1898—nearly 90 per cent. The normal increase deduced from this record of 19 years is at the rate of $18,000,000 annually, but during the five years since 1893 the rate of increase has been nearly $25,000,000 annually. While the normal rate of increase may lie somewhere between these figures, the totals are marked by great irregularities. From 1894 to 1895 the increase was nearly $100,000,000, and in the following year the increase was only a little over $1,000,000, while in the two years from 1892 to 1894 there was a decrease, owing to the business depression, of over $121,000,000. From 1896 to 1897 the increase was about $8,000,000, about 1.3 per cent., while from 1897 to 1898 the increase was $66,970,534, more than 2½ times the average annual increase from 1893 to 1898, and a gain of nearly 11 per cent. over the value of the product in 1897 ($630,909,468). The total of $697,880,002 in 1898 was the largest ever recorded in the history of the United States, exceeding that of 1892, which held the record prior to 1898, by nearly $50,000,000. This great increase in 1898 is due to a general increase all along the line of mineral products, all of the more important of these showing large increases and almost everyone showing some gain.

For the mineral products in which electrical men are more especially interested these reports are made:

Copper.—The copper industry continues to be in a flourishing condition. The product in 1898 was 526,512,987 pounds,[1] valued at $61,865,276, the greatest product and value ever recorded, 494,078,274 pounds, valued at $54,080,180, having been produced in 1897. The average price per pound in 1898 was 11.75 cents; in 1897 it was 11 cents, and in 1896 it was 10.5 cents. The actual scarcity of copper, with its accompanying rise in price and its enormous expansion of stock speculation, did not develop until the end of the year, and did not affect the returns for 1898. Nor is the great activity in the location of new copper mines apt to add materially to the copper product of 1899 on account of the time required to open copper properties and provide reduction plants.

Zinc.—The production of zinc also increased to 115,399 short tons, valued at $10,385,910, from 99,980 short tons, worth $8,498,300, in 1897. This, too, is the largest product recorded for this country.

Aluminum.—The production of aluminum made a notable gain in 1898 over 1897. The product in 1897 was 4,000,000 pounds, valued at $1,500,000, and in 1898 it was 5,200,000 pounds, valued at $1,716,000.

Mica.—The sheet-mica product continued to increase, rising from 82,676 pounds in 1897 to 129,520 pounds, a gain of 56.66 per cent. in 1898, which is the largest product since 1885. The value increased, though not in the same proportion as the product. It rose from $80,774 in 1897 to $103,534—$22,760—or 28.18 per cent. In addition, there were sold 3,090 tons of scrap mica for use in the manufacture of lubricants, wall papers, boiler coverings, etc., valued at $27,564, as compared with 740 tons in 1897, valued at $14,452.

Electrical Machinery for the Deering Works.

Some time ago the Western Electrician described the electrical machinery that had been installed at the works of the Deering Harvester company of Chicago to operate the twine mill. Orders have now been given to the General Electric company for generators and motors, which will increase the present capacity of the power plant by 2,100 kilowatts. A duplicate to the 750-kilowatt alternator now installed, a 250-kilowatt and a 1,100-kilowatt alternator will be added. These large machines will be three-phase, 40-cycle, direct-connected, slow-speed alternators, and will be used to drive induction motors, aggregating about 1,000 horse power. Nearly 900 horse power in motors is now in use in the twine mill and nearby shops. To accommodate these additions to the electric generating plant a new power house is being erected. It is hoped to have the new plant running in about two months.

It is suggested that perhaps one of the most useful possibilities of wireless telegraphy is to keep up connection with exploring parties going into remote portions of the world. "If Signor Marconi's confidence is well founded," says the Chicago Record, "Walter Wellman could have been in communication with London or New York during his entire journey. The lost Andree might have kept the world advised of his movements. In such a country as Alaska intercourse could be held between different camps and the hardship and danger greatly reduced in consequence."

1. According to the figures of the Engineering and Mining Journal, published in the Western Electrician on August 5th, the production of copper in the United States in 1898 was 239,241 long tons, or 535,899,840 pounds, an amount slightly in excess of the government's report.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independents of Shelbyville Not Easily Discouraged.

When fire destroyed the exchange of the Mutual Telephone company of Shelbyville, Ind., a few weeks ago, the citizens feared that the stockholders would become discouraged and dispose of their plant. The fight made by the Central Union against the local company has been so hard, says the Indianapolis News, that the stockholders of the latter have been compelled to put all their earnings into improvements. Not less than $5,000 was spent this summer in building new lines and placing the plant in an up-to-date condition. This work had not been completed two weeks, and the Indianapolis line had not been in operation a week, when fire destroyed everything in the exchange. A move was made in three hours after the fire to rebuild the exchange, and it has been successful. Overtures have been made for the purchase of the plant for the purpose of turning it over to the Central Union, but all these have failed. Ten thousand dollars' worth of bonds, drawing six per cent. a year, have been issued, the stockholders taking up 40 per cent. of the value of their stock in them. A new exchange is now being built. The Central Union is still giving all houses the privilege of free telephones, but the citizens are loyal to the home company and are waiting patiently for the new exchange to open.

On August 7th an order was placed with the Sterling Electric company of Chicago for an entire new equipment, consisting of a 500-number switchboard, 800-number distributing board, combined office terminals and protectors, pole-top terminal and line fuses, the contract calling for the installation of the whole. The order was filled before September 1st, notwithstanding the fact that the Sterling company's factory was in an overcrowded condition, and was already running night and day on unfilled orders. This was certainly a piece of quick work, reflecting credit on both the local exchange and the manufacturing company.

Subway Dispute in Baltimore.

The Chesapeake and Potomac Telephone company has applied to the courts for an injunction to restrain the city of Baltimore from interfering with it in the construction of its private subway system. There has been an almost continual dispute over this matter for a year, the controversy being in the courts in one form or another for the best part of that time.

The present suit is based on the refusal of the city to issue permits to the company for the further extension of the system of the latter. It is desired by the telephone officials to go ahead with their plans, and as the city will not voluntarily grant them authority to do so, they wish to proceed under the protection of the court, if that can be secured.

The city's position in opposition to the proposed work of the company is taken in the interest of the success of the general subway which it is now building. It has been shown by Chief Engineer Phelps that the private system of the telephone company, if continued under the plans decided upon, will interfere seriously with the city's conduit system, as well as place insurmountable obstacles in the way of a sewerage system, such as the city is now contemplating.

Removal of American Bell Company.

Writing from Boston, a correspondent of the New York Herald says that the report of the removal of the headquarters of the American Bell Telephone company from Boston to New York is neither confirmed nor denied officially, but has obtained wide circulation. He adds:

The main issue, the consolidation of the Bell and Long-distance companies of New York, is generally regarded as settled. One rumor is that the exchange is to be made on a basis of three shares of Long-distance stock for one share of Bell Telephone, with the privilege of subscribing for an additional share of Long-distance at par, the Long-distance to pay six per cent. Another rumor that seems more plausible is that the exchange will be on the basis of only two shares of Long-distance for one of Bell Telephone. In the latter event there would still remain in the treasury nearly $23,000,000 of Long-distance stock, and the rumor was somewhat cloudy as to the ultimate disposition of this balance.

At first glance, this latter rumor looks rather ridiculous, inasmuch as the Long-distance stock pays only five per cent., while the Bell stock is paying 15 per cent. and sold on the market to-day [August 30th] at 365. But the Long-distance company of New York would be simply the Bell company operating under another name, and as a New York corporation instead of as a Massachusetts corporation.

The matter of taxation does not seem to be the reason for the proposed transfer. The manner in which the company is directed by statute to barter its stock seems to be the objectionable feature.

There is an opinion in some quarters that, even if the company did become a New York corporation, its local interests would remain practically unchanged. It would make New York its headquarters only as far as it might be necessary to comply with the laws of the state.

Kinloch Telephones in St. Louis.

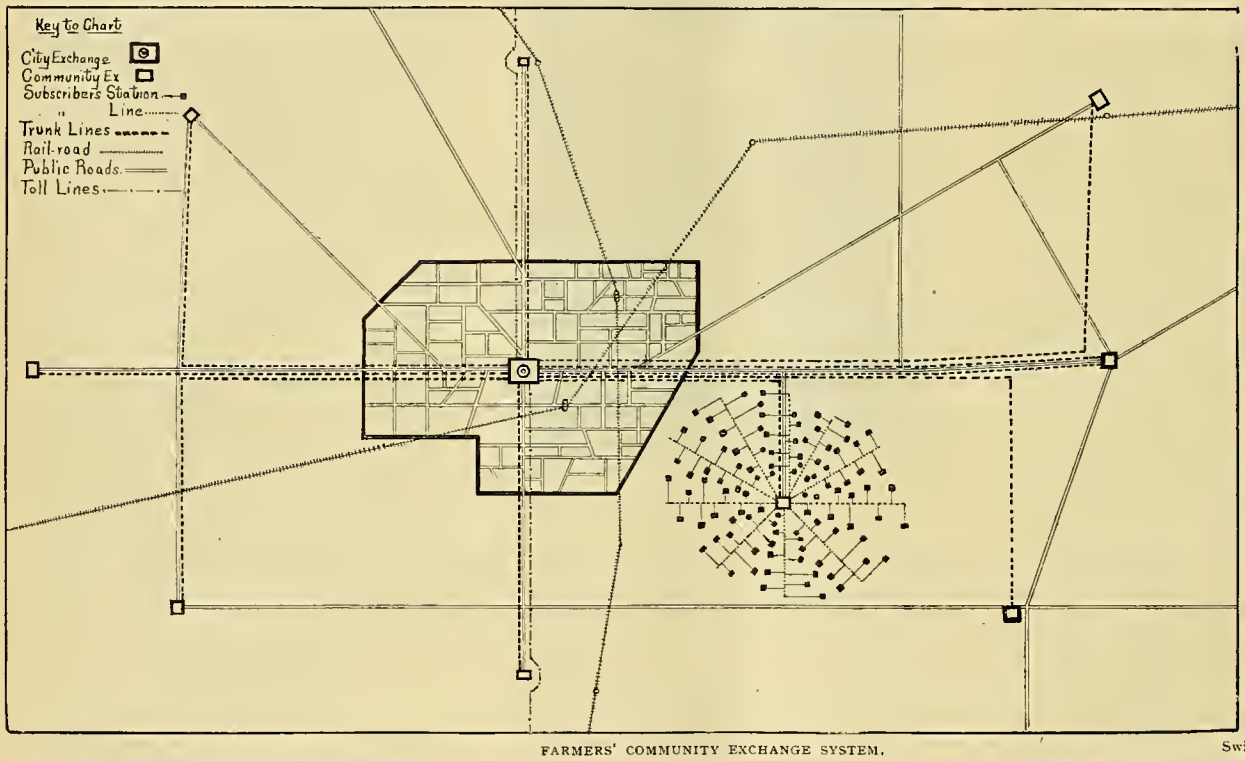
In a recent statement Mr. H. J. Hanford says that the Kinloch Telephone company of St. Louis has 4,812 telephones in actual operation and is putting in 2,600 more. The present exchange capacity is for 6,140 instruments. The rates are from $36 per annum for residences to $60 for business houses. The average return from those in operation is $53.94 per annum. It is asserted that the entire expense of operation and maintenance is about $20 per annum for each instrument. "Our capital," says Mr. Hanford, "is $2,000,000, and our authorized bonded indebtedness is $2,000,000, of which $1,400,000 have been sold to the Mississippi Valley Trust company for cash. At this early date we are able to pay the interest on the bonds and four per cent. on the capital, and within six months we shall be able to pay from seven per cent. to 10 per cent. on the capital stock. We have sent out bills for six weeks' service, and up to this time four-fifths of our customers have paid; the next lot of bills will very likely be paid up almost entirely. We have the support of the public and the entire enterprise is a pronounced success."

A telephone line will be constructed at once from Grand Meadow, Minn., to Pleasant Valley township.

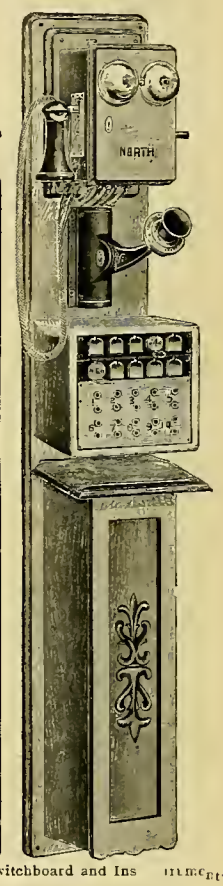
Farmers' Community Exchange System.

To extend the telephone service of cities or towns into the homes in the surrounding rural districts is a creditable undertaking, and the North Electric company of Cleveland is entitled to praise for its original work in devising a system to this end. It is the boast of the Independents that the telephone has been put within the reach of the common people of the cities. Now, it is contended that to complete the work the farmers in the territory surrounding every city or town should have connection by telephone not only with their neighbors, but their friends in the city, as well as the physician, butcher, grocer and commission man.

As will be seen by the accompanying chart, the North company contemplates having the surrounding country territory well covered by this class of service. There are located at various points switchboards of the type shown in the cut of the telephone instrument. From this central board there radiate several lines, to each of which are connected from eight to 10 subscribers' stations. Each community exchange is connected by trunk line to the nearest city exchange. In this way a patron is enabled to connect with any of the other subscribers connected to his own exchange, or by trunking to the city exchange can be connected to any of the subscribers of the city exchange or other community exchanges. He can also get connection with any of the toll lines that connect with the city exchange. It is reported that city exchanges have had their toll revenues materially increased in this way.



FARMERS' COMMUNITY EXCHANGE SYSTEM.



Switchboard and Ins ument.

It will be seen by consulting the chart that where exchanges have toll lines running into the city these pole lines can be utilized for bringing in the trunk lines to the community exchanges, thus saving considerable expense. By running trunk lines in the way shown but a comparatively small expense is incurred outside of running the subscribers' lines to their respective Centrals and the equipment.

The switchboard furnished is said to be free from all delicate or complicated devices, and so simple that a child can operate it. The telephones furnished are of the long-distance type and powerful enough for conversation to the remotest points.

It is claimed that this system has passed the theoretical point and has proven its practicability in the hands of several exchanges. It has also been found that the net earnings of these exchanges have been materially increased. In some localities where the city exchange has not furnished this class of service to the farmers, they have organized their own companies, built their lines, arranged for city connections and are rendering a successful service.

In the accompanying chart the subscribers' lines radiating from the various community exchanges are shown only in connection with one of the exchanges. Let the reader imagine subscribers' lines radiating from each of these community exchanges and he can realize how far-reaching is this system. It is said that the plan is meeting a warm welcome from exchange managers.

NEW COMPANIES.

The Hico Telephone company has been incorporated in Austin, Tex., with a capital of $2,500.

The Kosciusko Telephone company has been chartered in Jackson, Miss., with a capital of $50,000.

The Union Telephone Exchange of Keyser, W. Va., has been incorporated, with a capital of $50,000. George Davis, Keyser, W. Va., is interested.

The Baldwin and Sebeago Telephone company of Cornish, Me., has been incorporated to operate a telephone line. W. H. Fitch of Sebeago is interested.

The Otterbein Telephone company of Otterbein, Ind., has been incorporated with a capital stock of $10,000. The directors are Lewis Leaning, Isaac E. Switzer and Robert H. Bolt.

The National Telephone Device company of San Francisco has been incorporated to buy and sell telephone patents. The directors are J. Kahn, A. M. Brown, N. A. Judd of San Francisco and others. The capital stock is $100,000.

The Clayton (N. Y.) Mutual Telephone company has been incorporated to operate a telephone exchange. The capital stock is $10,000, and the incorporators are J. C. Winsted, A. R. Morley, E. B. Owen, H. Brown, R. S. Woodson, C. C. Walls, W. E. Hubbard, all of Clayton.

The Covington (Ind.) and Coal Creek Co-operative Telephone company has filed articles of incorporation. The company consists of A. P. Burnsides and five other shareholders, and the capital stock is $10,000. It will operate lines in Fountain, Warren, Vermillion, Parke and Montgomery counties, and the headquarters will be at Covington.

The Syracuse, Rochester and Lake Ontario Telephone company has been incorporated to operate in Syracuse, Rochester, Oswego, Auburn, Geneva and intermediate places. The capitalization is $100,000, and the directors are Sherman E. Bishop, Alvin B. Bishop, A. M. Graham of Clyde, Jacob Strauss, William Scott, C. H. Towlerton of Lyons, and E. S. Bishop of Rhinebeck.

A number of business men of Stillwell and Perkins, O. T., have organized a company and will construct a telephone line between the two Payne County towns. They have raised the point that tolls charged by the Arkansas Valley Telephone company are too high, and they promise a reduction. The men interested are W. A. Knipe, John Youst, Richard Hicks and Cliff Rock.

The Burke County (N. C.) Telegraph and Telephone company has been organized. It is authorized to operate telephone exchanges in Morganton and throughout the county of Burke, with the privilege of extending its line elsewhere in the state. The amount of capital stock is $3,000, and the incorporators are George I. White, Sinclair M. McDowell of Marion and W. C. Ervin of Morganton, N. C.

At a recent meeting of business men of Red Lodge, Mont., there was formed the nucleus of a stock company having for its object the erection of a city telephone exchange and the construction of a long-distance line connecting Red Lodge and the Big Horn Basin, Wyo. Dr. J. M. Fox was elected chairman and J. S. Robbins was secretary of the meeting. The directors were instructed to have articles of incorporation drawn up for the Red Lodge and Wyoming Telephone company, with a capital of $10,000. The directors are to be W. A. Talmage, B. E. Vaill, J. S. Robbins, J. M. Franklin and J. N. Tolman.

A Contrast in Leelanaw County.

"The Michigan Telephone company," says the Traverse City (Mich.) Eagle, "can talk more and do less than any corporation of its size that we know anything about. For the last six years it has been promising us telephone connection with different places in Leelanaw County, and so far it has been nothing but talk. The only connection it has ever given us is a line to Suttons Bay, and that was not built by the company, but by private enterprise. In contrast with this it may be stated that the Northern Telephone company commenced work here less than a year ago, and has not only built a complete exchange for the city in first-class shape and has over 200 instruments embraced in it, but its principal stockholder, Mr. Wheelock, has in the meantime built a line extending into Leelanaw County, reaching Keswick, Bingham, Suttons Bay, Omena, Northport, Provemont and Leland. We have waited a good while for the Bell people to give us telephone service into Leelanaw County in fulfillment of their promises, but so far we have waited in vain; but now we have such connection with the points named, given us while the Bell people have been talking about it."

It is said that the farmers are beginning to take advantage of the opportunity offered by the Northern Telephone company to become connected with the Traverse City exchange. The company has established what it calls the "farmers' party line." Subscribers to this service have the free use of all telephones in the city exchange, without the payment of tolls.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The local telephone exchange at St. Peter, Minn., has been sold by W. P. Proctor & Son of Viroqua, Wis., to H. G. Slater and James Bennett of St. Peter.

The Northwestern Telephone Exchange company has temporarily receded from its position to compel Minneapolis druggists to put in nickel-in-the-slot machines by refusing connections to any but the subscriber or employes. It does not yield the point by any means, but pending a settlement the old system of giving connections to all callers will be restored.

The Central Wisconsin Telephone company will put in an exchange at Montello, Wis.

The Northwestern Telephone Exchange company has made a lower long-distance rate from Mankato, Minn., to some of the smaller towns in the vicinity.

It is said the Mississippi Valley Telephone company has put in place 1,000 instruments for its new exchange in St. Paul.

Frank V. Alden, manager of the Mississippi Valley Telephone company's office at Fort Madison, Ia., has been appointed to a similar position at Minneapolis.

The Wisconsin Telephone company will bury a large portion of its wires in Madison, Wis., and has applied to the council for permission to begin work.

The line of the Minnesota Telephone company is about completed from Sandstone to Pine City, Minn.

The Telephone association of Arlington, Minn., at its annual meeting voted that it would consider an offer of $10,000 for the system.

The local telephone exchange at Wadena, Minn., finds its business increasing satisfactorily. A toll line to Sauk Center is planned.

The Board of Education at Oshkosh, Wis., is the storm center of a battle between the Northwestern Telephone company and the Wisconsin Telephone company. The latter offers to place telephones in each of the public schools at a figure considerably less than the local company has been doing it. There are arguments for sustaining the local company against a foreign corporation and other arguments for running the schools as cheaply as possible.

The Northern Minnesota Telephone company is ready to install an exchange in Park Rapids, Minn., if the business men there will maintain it.

The Wisconsin Telephone company will erect a two-story and basement building in Oshkosh, Wis., for its exchange. Its wires will probably be buried in the business section.

The Minnesota Central Telephone company contemplates an exchange at New Painesville, Minn.

The Little Wolf River Telephone company is installing its exchange at Fond du Lac, Wis., as rapidly as possible.

The city controller of St. Paul has filed a protest with the Board of Public Works against the Northwestern Telephone Exchange company, charging that it has failed to repair paved streets where excavations have been made for underground conduits.

The Fergus Telephone company of Fergus Falls, Minn., has just installed a long-distance telephone board.

The St. James (Minn.) Telephone company has made a traffic arrangement for toll service with the Northwestern Telephone Exchange company.

The Northwestern Telephone Exchange company announces a reduction in toll service from Albert Lea, Minn., to towns in the vicinity.

The Zenith Telephone company expects to have its exchange in Duluth, Minn., in operation by October 1st.

Telephone service in Minneapolis suffers somewhat from the kites of small boys becoming entangled with the wires. If the tail winds around the wires and becomes wet a short-circuit results, and some subscribers find their instruments do not work and become enraged thereat.

A. A. Schneider of Wausau, Wis., now has charge of the Wisconsin Telephone company's exchanges in Merrill and Wausau.

Minneapolis capitalists contemplate organizing a home telephone exchange at Stanley, Wis.

The Cedar Valley Telephone company proposes to establish a local exchange in Iowa City, Ia., in case A. T. Presson withdraws.

The Citizens' Telephone company now has connection between Corning, Ia., Mercer and Prescott, and will soon connect with Carbon.

A telephone line is projected from Promise City to Allerton, Ia.

The Northern Telephone company of Fonda, Ia., has been granted a franchise at Newell, Ia.

The Red Lodge and Wyoming Telephone company has been incorporated to build a telephone line from Red Lodge, Mont., to Basin City, Wyo.

The Northwestern Telephone Exchange company at Grand Forks, N. D., kept a record of the calls through that exchange for August 24th, 25th and 26th. The first day there were 4,104 local and 722 long-distance connections. The second day there were 5,156 local and 634 long-distance connections, and the third day there were 4,538 local and 614 long-distance calls.

The Commercial Telephone company has its connection from Toledo, Ia., to Marshalltown completed and is building a line to Garwin and Gladbrooke.

The Iowa Telephone company has added four operators to the switchboard in Davenport, Ia., owing to increased work.

Independent Toll Lines in Kentucky.

[From the Owensboro, Ky., Messenger.]

The Harrison Telephone company has just gotten out a new directory, and in addition to its containing a greater number of names than any previous issue, it contains 40 toll stations, a number of which are exclusive. While the Harrison company is in its fourth year of operation, it has not until recently begun the building of toll lines, but since it has gotten started in this direction it will soon reach an important place in the long-distance telephone business. Its lines now run as far east as Cloverport and as far west as Morganfield, and there is under construction a line from Fordsville to Owensboro; also a line from Hartford to Owensboro via Livermore and Lewis station.

Its officers claim that within a year it will have 200 toll stations, including Evansville, Louisville, New Albany, Indianapolis, St. Louis, Cleveland and many other important points.

That independent telephone companies are a good thing for the community is easily seen when cities like Lexington and Paducah are compared with Owensboro as regards telephones. Lexington and Paducah both have been clamoring for Independent exchanges for two years and both are almost absolutely without long-distance connection and are very poorly served locally. This is on a par with the Bell company's policy elsewhere—only improve where they are compelled to, the kicks of the public to the contrary notwithstanding.

New Work in Kansas.

[From a Topeka correspondent of the Western Electrician.]

The Missouri and Kansas Telephone company is building a metallic circuit line between Topeka and Holton, Kan., and St. Joseph, Mo.; also a branch connecting Whiting with the Atchison line.

An Independent telephone company has been granted a franchise at Abilene, Kan., in opposition to the Bell company.

Mr. D. K. Rinehard, of the Holton Telephone company, is building an exchange at Osage City, Kan., and expects to build at Lyndon and Burlingame and connect the three with a toll line.

Mr. Charles C. Wells, formerly president of the Iowa Telephone association and the Boone County Telephone company of Iowa, has just completed a fine exchange at Marion, Kan., and will build at Florence and Peabody, Kan., and connect the three by toll lines with Hutchinson and Salina.

The Washington Telephone company of Washington, Kan., has just finished a line to Greenleaf, which connects with the lines of the Interstate Telephone company of St. Joseph, Mo., which gives Washington connection with the outside world, or rather with four states. Washington has one of the most prosperous telephone exchanges in Kansas.

MANUFACTURERS AND DEALERS.

The Continental Electric Telephone company of Chicago, with authorized capital of $50,000, has been incorporated to manufacture telephones and electrical apparatus. The incorporators are George F. Stitch, Tiodolf Lidberg and Alan I. Coyne.

Among the recent contracts made for exchange equipment may be mentioned that of the Galena Telephone company of Galena, Kan., which has just placed an order for switchboard, protectors and distributing board with the Sterling Electric company of Chicago. The Galena company expects to begin giving service before the first of October.

Two neatly illustrated pamphlets have been issued by the North Electric company, 61-73 Frankfort street, Cleveland. One is devoted to exchange switchboards and contains descriptions and illustrations of standard 100-drop and multiple boards, plugs, spring jacks, line drops, repeating coils and table equipment. In the other pamphlet are described several different types of subscribers' instruments and desk sets.

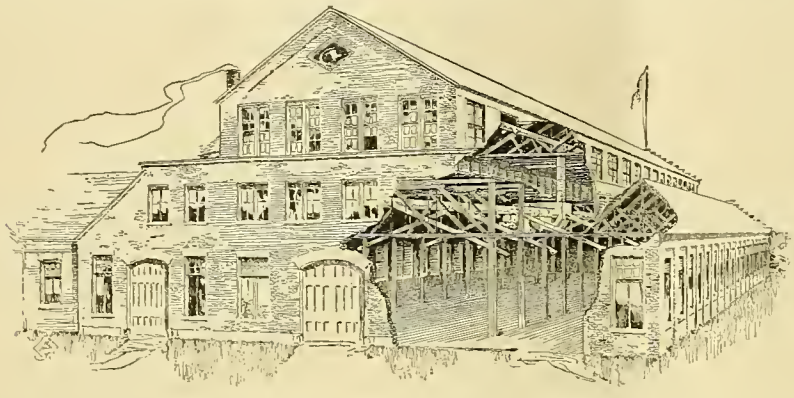
The Farr Telephone and Construction Supply company, Chicago, is receiving orders for its products from all over the country. The company has never been so rushed with orders as it is at present, which shows that its product is appreciated. The Farr company recently issued a new handbook of information, showing how to build exchanges and country lines. This pamphlet also contains much other information which should be of value to telephone men.

The telephone companies doing business in Michigan, numbering 40 or more, escaped taxation last year by the decision of the Supreme Court which declared the valuation law of 1881 invalid; but the attorney-general has given an opinion that they can be taxed under the law that was in force before the valuation law was passed. This law provides for a specific tax on the earnings of the companies.

Special Application for Ventilation and Heating.

A somewhat unique structure at the works of the Capewell Horse Nail company, Hartford, Conn., is shown herewith, the upper portions of the space in the center being formed into a second floor. The ventilating and heating apparatus, which is of the blow-through type, is supported upon the trusses just below this floor and midway of the length of the building. From either side of the heater there extends a horizontal pipe nearly down to the end of the building. Branch pipes from these mains are carried downward and outward to the side bays, into which the air is directly discharged, none being delivered to the center of the building.

From the top of the heater another pipe, extending upward, supplies a horizontal main with its series of outlets for the second floor. Evidently,



SPECIAL APPLICATION FOR VENTILATION AND HEATING.

both upon the main and the second floor, the apparatus and piping occupy the minimum of space.

Here the location of the apparatus itself had a marked influence upon the method of heating to be adopted. The apparatus is almost exactly in the center of the building, and is arranged to take its supply from the building itself, when desired. When so doing the air delivered at the most distant points, that is, in the outer bays, is gradually drawn inward to the large center bay, heating it, so far as its lesser requirements demand, and finally passing again through the fan. Had a less extended system of piping been adopted, the tendency toward a vacuum in the vicinity of the fan, although scarcely perceptible, would have extended a powerful influence to prevent the air reaching the extreme ends and sides of the building before its return to the fan.

The B. F. Sturtevant company of Boston installed this interesting plant.

Canadian Development of the Telautograph.

Foreign and domestic patents were recently allowed to Thomas J. Murphy, a young electrician of Montreal, for what is claimed to be a new system of electrically transmitting intelligence to great distances. The apparatus comprises a transmitter in the form of a style or pen and a receiver. The former is so arranged and connected electrically that if the pen is drawn in a definite direction a definite signal at the receiver will be actuated corresponding to the direction in which the pen is moving. No previous knowledge of telegraphy is necessary in transmitting a message by the system. In conjunction with the phonautograph, Mr. Murphy is said to have devised a means by which it is entirely practicable to send at least 15 separate messages on the same line simultaneously without any interference whatever. It is also possible that multiplex working on submarine cables is within the possibilities of the instrument. The same inventor has made application for patents on a telautograph.

Instrument to Locate Grounds.

The American Electric Specialty company of New York is placing on the market a new instrument which is exactly similar in outside appearance to that company's direct-reading ohmmeter, and which is intended to be used for the purpose of correctly locating grounds or short-circuits. It can also be used where both ends of the grounded conductor are available.

Three binding-posts are provided on the instrument. The two outside posts are connected to the conductor to be tested, and the middle post is connected to the nearest steam, gas or water pipe. Telephone is placed to the ear and the key depressed, and silence is sought for on the wire.

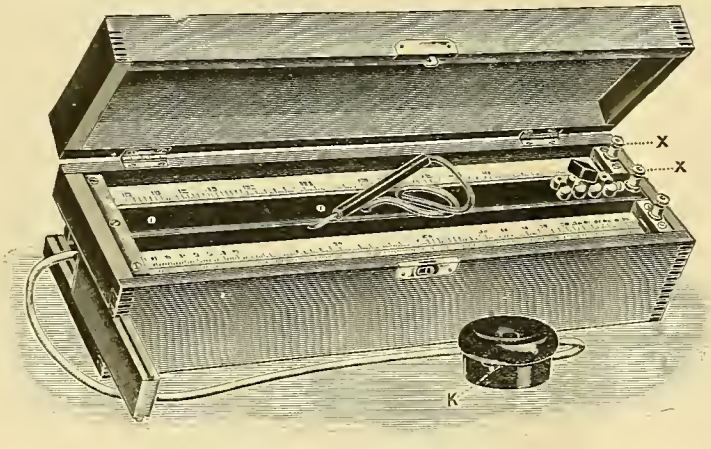
The reading of the scale represents a percentage, which, when multiplied by the total length of the conductor, gives the distance in feet of the fault from the zero binding-post. Thus, if a telephone cable 1,000 feet long was tested and a ground should be found on one of the leads, the method would be to connect the two leads together at their distant end, and connect the two free leads at the same end to the outer terminal of the instrument and the sheathing itself to the middle binding-post. If, then, the instrument should indicate 0.30, the fault would be .3 times 2,000, or 600 feet away from the zero binding-post.

The instrument can be conveniently used to locate short-circuits in long lengths of cable, in which both ends of the cable are available, by the device of simply connecting two free ends of one of the short-circuit lines to the outer posts of the instrument, and one of the ends of the other line on which the cable was short-circuited. The procedure will then be the same as before. If the length of the cable is accurately known, the short-circuited place can be located within one or two inches, and can be cut out and removed on the first trial, thereby saving many cuts in the cable.

The instrument is provided with dry batteries like the ohmmeter, but as it has only one scale and no calibration, it is a cheaper instrument.

Another adaptation of instruments of this kind is the use of the ohmmeter as a pyrometer. A resistance wire of known temperature coefficient is suitably insulated and placed in the source of high temperature. Its resistance rises with the temperature, and the rise in resistance is quickly and accurately measured by the ohmmeter. This instrument will be calibrated to read in degrees directly with any given pyrometer resistance on special order.

The original ohmmeter is now manufactured and very largely sold by the company, the instrument having found great favor for any purpose where rapid resistance measurements are to be made.



INSTRUMENT TO LOCATE GROUNDS.

The Tonawanda Power company has received the contract for lighting the streets and public buildings of North Tonawanda, N. Y., for the ensuing year for $14,500.

Association of Edison Illuminating Companies.

The annual meeting of the Association of Edison Illuminating Companies is to be held at Hotel Lafayette, in Philadelphia, commencing Tuesday, September 12th. Papers will be read on the following subjects: "Foreign Meter Practice," "Automobiles," "Methods and Statistics," "Alternating-current Transformer System," "Stationary Motors," "Report of Lamp-testing Bureau." The Edison Electric Light company of Philadelphia is planning to entertain the delegates and is arranging for a number of short excursions to points of historic interest. The following-named gentlemen are the officers of the association: President, R. R. Bowker, New York city; vice-president, George R. Stetson, New Bedford, Mass.; treasurer, W. S. Barstow, Brooklyn, N. Y.; secretary, Wilson S. Howell, Newark, N. J.; executive committee, R. R. Bowker, New York city; Alexander Dow, Detroit, Mich., Charles L. Edgar, Boston, Mass.; Samuel Insull, Chicago, Ill.; John W. Lieb, Jr., New York city; J. H. Vail, Philadelphia, Pa.

CORRESPONDENCE.

New York Notes.

New York, September 4.—New Yorkers are slowly opening their eyes to the fact that there is an advantage in electric power for street-railway operation. The Metropolitan Street Railway company's annual report is a striking illustration of the economy of the underground trolley as compared with animal power. The report shows that the cost of operating the great system has been reduced to the remarkably low ratio of 48.75 per cent., as against 52.3 for the previous year. It cost 59 per cent. to operate the Manhattan railway by steam power and 55.8 to operate the Third avenue system by cable.

A series of tests of street-railway brakes has just been begun by the New York State Railway Commission. Each of the 22 brakes which the commission has selected will be put to 15 tests at the speed of eight, 12, 16 and 18 miles an hour. Among those who have been present at some of the tests may be mentioned the following-named gentlemen: Colonel Ashley W. Cole, George W. Dunn and F. M. Baker of the commission; President Vreeland of the Metropolitan street-railway system; G. Tracy Rogers, president of the New York Street Railway association and of the Binghamton Street Railway company; Charles R. Barnes, electrical expert for the commission, and F. D. Brown, general superintendent; W. H. Pierson, electrical engineer; J. J. Shea, general foreman, and Thomas Millet, general master mechanic of the Metropolitan system.

Father Knickerbocker is getting ready to fall into the line of progress, as automobiles will very likely be introduced into the Fire Department. Ever since he took office Chief Edward F. Croker has been impressed with the advantages of automobiles, particularly for his own use, in getting to remote fires, and has begun a series of experiments with them. He recently tried an automobile made by a new American company, and after a ride of about 40 miles through the borough of the Bronx, during which he tried the machine under all road conditions of hill and level, smooth and rough, he was enthusiastic about his experiences.

From Schenectady, N. Y., comes the report that there was an explosion on the morning of September 1st in the underground tube works of the General Electric company, setting fire to the building. George Ruflee, the foreman of the shop, and two laborers were badly burned, the former perhaps fatally. The loss will amount to $5,000.

It is reported that within a short time there will be a meeting between the controlling forces in Metropolitan Street Railway company and those of the Brooklyn Rapid Transit company, and that Mr. William C. Whitney will go into the Brooklyn directory. Mr. Brady, who is very heavily interested in the Brooklyn company, is a director in the Metropolitan company also. The meeting will be for the purpose of bringing about closer relations between the two companies, relations which may prepare the way for ultimate consolidation.

Joseph B. Cooper, formerly a trolley-car conductor, has lodged a complaint with District Attorney Hiram R. Steele, which will form the basis for a suit to test the 10-hour law, which Cooper asserts was violated in his case by the Brooklyn Rapid Transit company. Cooper claims that on several occasions he has been compelled to work more than the 10 hours in order to cover the five trips he was scheduled to make on his line.

It is said that the Brooklyn Rapid Transit company has purchased from L. Bradford Prince a tract of land lying between Flushing and Corona. There are 25 acres included in the purchase. On this land the Rapid Transit people expect to build an immense car and power house of brick and slate, to replace the old car barns at Maspeth.

New York objects to reckless motor drivers. Acting Captain McCormack of the bicycle squad came near being run over the other night at Broadway and Fifty-eighth street by an automobile. He decided to make a special post of Broadway from Forty-seventh to Fifty-ninth street, and detailed

"Ajax" Whitman to it, with instructions to arrest the motormen of all automobiles who "scorched" on Broadway.

The first of the 100 new cars which are to be put into service on the Third avenue line was received here Thursday afternoon. The new cars are about 40 feet long and accommodate 48 passengers. The seats, which are 24 in number, are arranged on each side of a center aisle, are upholstered in red plush and furnished with electric push-buttons. The exterior is painted a dark red. In addition to these cars, there are 70 box cars—that is, half open and half enclosed—now being constructed at the company's works at Harlem. These accommodate 52 persons each, and are similar to those operated by the Metropolitan company. It is said that the new cars when fully equipped will run from the Battery to Kingsbridge, at Two-hundred-and-sixteenth street, without transfer. Those now in use will be put on cross-town branches. G.

Canadian Intelligence.

Ottawa, Ont., Sept. 2.—The recent introduction of series enclosed arc lighting on alternating-current circuits by the Canadian General Electric company of Montreal is meeting with the approval of all central-station managers. The Sherbrooke Gas and Electrical company of Sherbrooke, Que., was the first to adopt this system in Canada. The Tramway company of Halifax, N. S., has just placed an order with the General Electric company for 100 of these lamps with transformers.

Two new directors are about to be elected to replace Messrs. Morice and Bique on the board of directors of the Royal Electric company of Montreal, and it is stated that Messrs. F. L. Wanklin and K. T. Blackwell are the gentlemen who will be added to the board. Both are practical, experienced business men who have achieved enviable success.

Profesor L. A. Herdt, lecturer on electricity at McGill University, Montreal, has written a letter to the Board of Trade of that city on the subject of lighting the channel of the St. Lawrence River, with a view to carrying on navigation at night. He proposes to place a searchlight on the bow of every ship. This would cast light upon a double row of white buoys defining the channel. If a steamer has a dynamo on board, the matter would be more simple; if not, a storage battery would accompany the apparatus. The matter was referred to the harbor engineer, to report at an early day.

Now that the city of Hamilton, Ont., has secured cheap electric power from near the Welland Canal, electricity is rapidly displacing steam in many of the industries of that city and vicinity, as well as being used to operate the street railway, electric-lighting plant and several radial railways that run out of the city. The latest proposal is to use electricity to operate the machinery at the sewage interception works.

The following will give an idea of what the Street Railway company of London, Ont., is losing by the strike of its employes, which has been in progress for some months, and which still continues, with little sign of abatement: The earnings for last June were only $1,042.17 and the operating expenses $1,666.62, a deficit of $3,624.45. In June, last year, the earnings were $9,790.86 and the expenses $4,177.90, a profit of $5,612.92.

The deal by which the Cataract Power company syndicate comes into possession of the Hamilton electric street railway, the Radial electric railway and the Hamilton and Dundas railway has been concluded, the business of the street railway passing into the hands of the syndicate on payment of about $130,000 for the controlling interest in the stock. It is understood there will not be any radical changes in the management of the railways for a while. The syndicate will shortly proceed to build electric railways to Galt, Guelph and Brantford, these being now projected. Hon. J. M. Gibson was elected president of the syndicate, Mr. John Dickenson, M. P. P., vice-president, and J. B. Griffith secretary-treasurer.

The city engineer of Ottawa has prepared a report in regard to the construction of conduits for the accommodation of the telegraph and telephone lines of the city. His idea is to build a brick conduit large enough to accommodate the gas and water mains, as well as the wires. From a surface of concrete, which is to be six inches in thickness, the height of the conduit to the crown of the arch will be four feet six inches. The width from side will be four feet. With straight walls, the top will be semicircular in shape, built of brick to a thickness of nine inches.

The value of radial electrical railways has been amply demonstrated wherever they have been built in Canada. They act as feeders to business centers; but from the point of view of the radial company, the chief difficulty is in securing sufficient winter traffic at first to pay expenses. In some rather unpromising routes along which these car lines have been built, the investors have been surprised at the amount of traffic which has been secured at that season, though the original estimates had been based on the summer patronage. Ottawa will have its first radial road under construction this fall, the Ottawa Electric company now being engaged in letting contracts for the construction of a line to Britannia. According to the plans filed, this line will not follow the traveled road most of the way, but will take a direct route across country, thus facilitating a fast service. W.

Northwestern Notations.

Minneapolis, September 1.—W. B. Baker and others propose an electric-car system for Ripon, Wis., if granted a franchise.

The new power company which proposes to transmit electric power to Stillwater and St. Paul, Minn., from Apple River Falls in Wisconsin, has begun work building dams and other incidental work, preliminary to the construction of a power house.

The Benton Power and Traction company of St. Cloud, Minn., will shortly begin work on a power house and car barn.

The Spokane and Northern Telegraph company is extending its wires to Greenwood, B. C., via Grand Forks.

Arrangements have been made at Tacoma, Wash., to place the city light and fire-alarm wires, telephone and traction companies' wires all on the same poles, and thus reduce the number of poles in the streets materially.

A far-reaching decision has been rendered in a Tacoma (Wash.) court against the Spokane Street Railway company, which is enjoined from allowing the gas company's pipes to be damaged by escaping electricity. The decision holds that the gas-pipes were affected by electrolysis, which could have been avoided by the use of new appliances. The street-railway company will appeal the case.

Negotiations are closed for the sale of the street railway at Green Bay, Wis., to the Fox River Electric company.

Larimore, N. D., has awarded a conditional contract to the Triumph Electric company for an electric-light plant.

The City Street Improvement company of San Francisco has the contract for a $10,000 extension for the Spokane (Wash.) Street Railway company.

The Snoqualmie Falls Power company has rather disappointed the people of Tacoma, Wash., by contracting with the street-railway company to furnish 5,000 horse power, which is its present capacity. The company was expected to be a sharp competitor of the street-railway and lighting company, especially in the matter of street lighting, but this seems to indicate that the railway company will use all the new company's power now, which will keep it from entering into competition.

A new 1,200-light dynamo has been ordered for the electric-light plant of Breckenridge, Minn.

The Omaha Railroad company will put in an electric signal apparatus at Ogden avenue in West Superior, Wis., and one at P avenue. It consists of a bell and an electric light. The approaching engine, at a given distance, sets the apparatus in motion, the light flashes and the bell sounds until the train has passed the crossing.

The Citizens' Traction company of Oshkosh, Wis., has increased the wages of its men from 13 to 15 cents an hour. Employes on the new interurban will receive 17 cents.

The Twin City Rapid Transit company has completed its line to Stillwater, Minn., and put it in operation. The fare from St. Paul to Stillwater, 22 miles, is 30 cents. The time will be 53 minutes when the new high-speed motors are received.

Professor Frederick S. Jones, head professor in physics at the University of Minnesota, gave a demonstration before the summer school in Minneapolis of the Marconi system of wireless telegraphy. He telegraphed without wire connections through a brick wall, and from one end of the Science building to the other without the aid of zinc reflectors.

J. K. Miller, Julius Witt and Daniel Jones, all of Oshkosh, Wis., are interested in an electric coupler, which is intended to give the engineer of a train notice if the train breaks in two. The contrivance can be placed on the cars at a cost of not to exceed $2.50 each.

The State Board of Electricity held its first meeting in St. Paul recently. About 30 local electricians were registered and 25 applied for licenses. A similar meeting was held in Minneapolis, before which about 60 electricians appeared and signified their intention of complying with the new law. R.

Detroit, Mich.

Detroit, September 2.—Conductor Albert A. Pierce of the Wyandotte and Detroit River railway, while replacing a trolley, touched the wire. The roof of the car was wet, and he received the current with such force that it threw him the entire length of the car. The muscles of his right arm were so badly lacerated that he will be disabled for some time.

The City Council of Portland, Mich., has offered the Portland Water company $20,000 for its plant, and the offer has been accepted. The purchase is conditional on the result of a popular election, which will be held to decide the matter. The city has an electric-lighting plant, in connection with which it is proposed to run the waterworks.

The Kalamazoo Valley Electric company, four miles from Allegan, Mich., proposes to furnish light and power for several cities and villages in the southern part of the state. The dynamos will be driven by large turbine water-wheels, which are nearly ready to run. An 80-ton dynamo, which has already been placed, will furnish 3,000 horse power. This company also proposes to operate an electric railway between Kalamazoo and Battle Creek, and will probably spread out still more extensively, as the Kalamazoo River furnishes almost unlimited water power.

The City Council of Saginaw, Mich., is trying to adopt a measure to force all electrical companies to place their wires underground. A resolution to that effect was referred to the committee on ordinances at a recent meeting, and the committee reported unfavorably, but the council referred it back, with orders to formulate an ordinance. The companies are making a hard fight against it, and if the ordinance is passed they will probably have it tested in the courts.

At Bay City the receivers of the Consolidated Street Railway company have given orders for the erection of a power house 75 by 100 feet in dimensions, to cost $60,000, and car barns adjoining, with capacity for 50 cars.

Several electrical concerns in this city have been summoned to appear in the Recorder's Court to answer charges of having violated the ordinance that requires them to take out permits before doing any wiring. They are making an energetic protest about what they consider too much officiousness on the part of Inspector McCarthy, who made the charges. The electrical companies have an association which will fight the City Lighting Commission, even through the Supreme Court, if necessary. One manager of an electrical company says that the inspector wants them to take out a permit to shift an electric-light wire from one desk to another in an office. One of his employes, he says, went to the office of the Delta Lumber company and showed the people there how to fix their plant, which was giving them some trouble. He did no work, but merely showed them how. The inspector found it out and the manager was hauled up before the court.

The Flint and Pere Marquette Railway company took out an injunction, restraining the Detroit, Plymouth and Northville Electric Railway company from crossing a corner of a bit of land claimed by the first-named company near its station at Northville. The injunction restrained the electric-railway people for a while, but Judge Donovan of the Circuit Court has dissolved it, and they can now complete the road unmolested. The judge held that the spot was public ground, having been used by the public unmolested for over 40 years.

Superintendent R. W. Hemphill of the Detroit, Ypsilanti and Ann Arbor railway has resigned. As his father is a large stockholder in the road, his resignation was a surprise, and no reason for it has been given to the public. J. H. G.

PERSONAL.

F. R. Babcock has been elected treasurer of the H. W. Johns Manufacturing company of New York city.

George A. McKinlock of the Central Electric company is a member of the Chicago committee appointed to raise money for the storm sufferers in Porto Rico. He represents the electrical supply interests.

Mr. W. J. Johnston, the former publisher of the Electrical World, arrived in Honolulu, on his journey around the world, on August 23d. He expected to sail from that port for Yokohama on September 9th, and to return to New York about the end of May, 1900.

The general superintendent of the Chicago Edison company, Mr. L. A. Ferguson, is spending a three weeks' vacation in the East. Before returning to Chicago Mr. Ferguson will attend the annual meeting of the Association of Edison Illuminating Companies, which is to be held in Philadelphia September 12th to 14th.

Mr. G. L. Patterson, of the electrical supply house of Stanley & Patterson, New York, has taken a well-earned vacation, which he will spend traveling through the lower provinces of Canada, visiting Charlottetown, P. E. I.; Halifax, N. S., and other points in that vicinity. Mr. Patterson has taken his fishing tackle, which he expects to use to good advantage. Mrs. Patterson accompanies him in his travels, which will last about three weeks.

Friends of Mr. W. L. Arnold of the Arnold Power Station company of Chicago who have gently chided him for not having taken unto himself a wife before this may now put aside their fears, for the marriage of that gentleman to Miss Ida Evans of Mount Vernon, Ill., is announced for September 7th. The news will be gratifying to Mr. Arnold's fellow-workers in the electrical fraternity and he will be heartily congratulated. The bride is the daughter of Mr. and Mrs. George W. Evans.

ELECTRIC LIGHTING.

The commissioner of Indian affairs is inviting sealed proposals, until September 18th, for constructing an electric-lighting system at the Indian school, Flandreau, S. D. All necessary information

may be obtained at the United States Indian warehouse, 235 Johnson street, Chicago, Ill., or of L. D. Davis, superintendent of the school.

The Bureau of Equipment of the Navy Department has recommended that the Thresher Electric company of Dayton, O., be awarded the contract for furnishing the Mare Island (Cal.) navy yard with three generating sets at its bid of $7,488.

The United States engineer at New London, Conn., is inviting sealed proposals, until September 27th, for furnishing and delivering an electric-light plant at that place. All necessary information will be furnished intending bidders upon application to Major S. S. Leach, New London, Conn.

At the recent annual meeting of the Steelton (Pa.) Light, Heat and Power company the following-named directors were elected: Samuel Couffer, Jerome Hite, Fred. E. Smith, Joseph A. Fletcher, John J. Barnett, W. H. Seibert, John Hess, George E. Coulson, C. H. Saul. The board organized by electing Samuel Couffer president, E. C. Keller secretary and George E. Coulson treasurer.

The Gloversville (N. Y.) Electric company has been transferred to the syndicate which secured control of the Johnstown company some months ago. The following-named directors have been elected: A. M. Young, New York; R. A. C. Smith, New York; H. G. Rinkle, New York; C. W. Hemmingway, New York; P. H. Hanson, New York; Paul T. Brady, Syracuse; John Begley, Gloversville.

According to the official statistics of the German empire, just published, it appears that 13 per cent. of the cities of Germany practice municipal ownership of electric-light plants. Of the cities with a population of more than 10,000, 517 in number, 120, or more than 23 per cent., own their own electric-lighting plants. Of the 2,700 smaller cities, 300, or 11 per cent., have municipally owned plants.

The stockholders of the Porterville (Cal.) Light and Power company held a meeting recently and organized, electing the following-named officers: President, Benjamin M. Maddox; vice-president, W. H. Hammond; secretary, A. D. Willson; treasurer, A. G. Wishon. The company has purchased the plant of the Porterville electric-light works and has contracted with the Mount Whitney Power company for power.

The Bureau of Navigation of the Navy Department is considering the question of improving the present plant for lighting the Naval Academy at Annapolis. It is expected that the plant to be installed will be of sufficient power to allow an increase, in order to furnish sufficient light for the new academy buildings. It is probable that an electric plant will be installed, notwithstanding that a recommendation has been received to use acetylene gas. There will be no delay in making the contemplated change, as the bureau can use a portion of the appropriation of last Congress.

ELECTRIC RAILWAYS.

Although work on the Northwestern elevated railway of Chicago is progressing steadily, it is believed that there is no probability of the road being in operation before March, and possibly not before June of next year.

The power house of the Niagara Falls Park and River railway of Niagara Falls, Ont., situated just above the Horseshoe Falls, in Queen Victoria Park, was destroyed by fire on the evening of September 4th. The loss is estimated at $85,000.

A street-car strike is threatened in Philadelphia which will tie up at least four of the city lines and may lead to a general tie-up. The strike comes at an unfortunate time, as the city is full of visitors called there by the G. A. R. convention.

The Aurora, Yorkville and Morris Railway company of Aurora, Ill., has been organized with a capital stock of $150,000. The officers of the company are: President and treasurer, H. H. Evans, of Aurora; vice-president, U. P. Ord, of Aurora.

The construction of an electric railway from Aiken, S. C., to Augusta, Ga., seems certain. The distance is but 16 miles, and between those two places are the villages of Bath, Langley, Vancluse, Warrenville and Graniteville, each with a large cotton mill.

The motormen of the Belle City Street Railway company of Racine, Wis., have received an order that they must register all fares hereafter. A bell, with a cord, has been placed on each car for the purpose. The motormen have refused to comply with the request.

The South Side Elevated Railway company of Chicago carried an average of 52,599 passengers a day in August, as against 41,770 in the same month of 1898. The gain is 10,829, or about 26 per cent., which comes on top of a gain of 54 per cent. in the month last year over August, 1897.

The Logansport, Rochester and Northern Traction company of Logansport, Ind., which proposes to build an electric railway between Logansport and Kendallville, a distance of 93 miles, has completed its organization by electing the following-named officers: President, J. T. McNary of Logansport; vice-president, L. W. Walker of Albion; secretary, George Holman of Rochester; treasurer, B. F. Keesling of Logansport; civil engineer, Walter Osmer of Logansport.

The Massachusetts railroad commissioners have approved of the consolidation of the Norton and Taunton, Norton and Attleboro, Mansfield and Norton and Mansfield and Easton street-railway companies as the Norton and Taunton Street Railway company. The capital will be $260,000.

A certificate of incorporation has been issued at Rockville, Md., for the Silver Spring and Sandy Spring Railway company of Montgomery County. The incorporators are Henry Nichols and Allen Freas of Silver Springs, Warren Choate of Rockville and William P. Springer of Washington City.

The General Electric company of Schenectady has the contract for building the power house and furnishing the equipment for the Clyde and Sodus Bay (N. Y.) Electric Railway company. This company has been recently consolidated with the Clyde Gas and Electric company, and the capital stock of the latter was increased to $350,000.

It is reported that the electric railway lines of the Seattle Traction Company, the Union trunk line, the West Street and North End Railway company of Seattle, Wash., have become the property of a Boston syndicate. The Madison street cable railway will be purchased in a few days, it is said; the price to be paid for the four lines being about $2,500,000.

The Diamond State Construction company of Dover, Del., has been incorporated, with a capital stock of $100,000, to construct electric railways in Kent County. Among the incorporators are Leo Belmont, Morris Bernheimer, William Graham and Colonel George F. Leland of Philadelphia, and Attorney-general White, Recorder Lord and others of Dover.

The following-named officers of the new Steubenville, Mingo and Ohio Valley Traction company of Steubenville, O., have been elected: President, William Hearne; vice-president, William Lipphart; treasurer, L. E. Sands; secretary, T. H. Eick; board of directors, William H. Hearne, William Lipphart, L. E. Sands, T. H. Eick, L. G. Hallock, H. S. Sands and John H. McKee.

The annual meeting of the stockholders of the Wilmington and Newcastle (Del.) Electric Railway company was held recently. The old board of directors was re-elected as follows: F. H. Treat, J. G. Vogler, H. H. Pearson, Jr., and C. P. King of Philadelphia; Peter J. Ford and Peter L. Cooper, Jr., of Wilmington, and Harry A. Richardson of Dover. The following-named officers were elected: President, F. H. Treat; vice-president and attorney, P. L. Cooper, Jr.; secretary and treasurer, C. P. King.

It is expected that by October 1st the power house of the Dublin tramway will be completed and that the new electric lines will be put in service soon after. Much of the machinery and apparatus for the power house has been furnished by American makers. The steel work has been done by the Riter-Conley Manufacturing company of Pittsburg, Pa., and the coal-handling machinery has been supplied by the C. W. Hunt company of New York. The engines are being built on the main floor by the E. P. Allis company of Milwaukee.

The Southwestern Missouri Railway company, that is to build an interurban electric railway of about 30 miles in length, with headquarters at Webb City, Mo., will operate its road by a system similar to that used on the Chicago and Milwuakee electric railway. The General Electric company, which furnished the equipment for the Chicago and Milwaukee line, will supply the machinery, which will consist of a 750-kilowatt, three-phase, 25-cycle alternator, four 150-kilowatt rotary converters and transformers, to reduce the line voltage of 11,000 to 370 volts.

AUTOMOBILES.

An interesting incident in the campaign for the Republican nomination for lieutenant-governor of Massachusetts is the announcement that one of the candidates has hired all the automobiles in Boston for use on caucus night, September 26th.

The first horseless carriage to ascend Mount Washington, the highest peak of the White Mountains, successfully accomplished the feat on August 31st. It was a gasoline vehicle, and made the ascent of 6,288 feet over a route of 10 miles in two hours and 10 minutes.

A campaign is being started in Paris against automobiles on account of their conductors' recklessness. Considerable complaint has been made on account of the fast driving of the automobiles and it is said to be extremely dangerous for a person to cross a street in Paris. In some parts the more reckless drivers have been stoned.

The sum of $1,000 is said to have been wagered on the result of a race between a Duryea and a Winton automobile. The challenge was issued by Dr. Morris of Galesburg, Ill., owner of the Winton, and is for a race of 100 miles on the Galesburg mile-track. It has been accepted by F. B. Snow of Wyoming, Ill. The race will probably be held some time after October 15th.

The stock of the National Motor Carriage company of Stamford, Conn., in one of whose automobiles John D. Davis and his wife recently began a trip across the continent, has been attached by various creditors, including a number of the employes. The exact amount of the claims against the company is not known, but they are believed to aggregate about $10,000. It is said that the difficulties were due to a reorganization of the company, and that all claims will soon be paid.

It is reported from Paris that the American Automobile and Motor company, Limited, has concluded a very important contract with the Locomobile company of America, of which A. L. Barber is president. The company has acquired all the rights of the Stanley automobile and, it is said, will receive about half the production of these machines. The officers of the company are: Chairman, Frank L. Gerner; vice-chairman, Albert Geiger of Boston; directors, Sebastian B. Schlesinger, D. de la Ville, M. Le Roul, P. Soberano and Baron de Vilaine. Vicomte de Jotemps is the general manager, with offices at 47 Boulevard Haussmann, Paris.

Three automobiles have been built at the works of the Fischer Equipment company in Chicago for the United States Signal Corps. One, a trap, will carry four men and will be used by the officers of the corps. The other two are covered wagons designed to carry the tools, signals, telephone apparatus, etc., necessary for a Signal Corps division. Each of these wagons has a carrying capacity of 1,500 pounds and a seat for two men. All three vehicles are equipped with nine horse power motors and are constructed under the Woods patents. They were built according to plans and specifications drawn up under the supervision of the government and will be tested in Chicago within a few days by officers from the War Department.

POWER TRANSMISSION.

The Southern California Power company of Los Angeles, the Pasadena Electric Light and Power company and the Los Angeles Edison Electric company have consolidated, under the name of the Edison General Electric company of Los Angeles. The capital of the new company will be $1,250,000. The company has a three-year contract for lighting Pomona, and will build at once a transmission line to Anaheim, Fullerton, Orange and Santa Ana.

PUBLICATIONS.

The Electric Appliance company, Chicago, has issued a neat pamphlet, illustrating and describing its Utility cardboard and celluloid shade.

What was formerly the American Street Railway Directory is now Powers' Street Railway Directory. The August issue is greatly enlarged and improved.

Steam Engineering, a new monthly, formed by the consolidation of Live Steam and the Engineer's Magazine, has made its appearance. It is owned by the Industrial Press of New York, proprietor of Machinery, with which the new publication will be affiliated. The first number (for August) is an interesting and creditable one.

The Columbia Electric and Manufacturing company of Chicago is issuing a pamphlet in which are represented some samples of its punch-press work, with illustrations. While making a specialty of the manufacture of electrical apparatus, this company also makes dies as well as special tools, machinery, etc., to order. Its circular and catalogue will be mailed free on request.

One of the greatest obstacles in the way of positively ventilating small apartments has been the difficulty of operating the fan introduced for the purpose. The B. F. Sturtevant company of Boston has made a careful study of this problem, has reduced the apparatus to its simplest form, and presents in its Bulletin M illustrations and descriptions of its electrically driven propellor fans. The motor is directly attached to the fan shaft. The fan is of the most efficient type and the entire arrangement is readily portable. It may be instantly started and stopped by the mere operation of a switch.

A pamphlet, entitled "Twenty-two Years' Life of Electrical Apparatus," issued by the General Electric company of Schenectady, N. Y., shows the growth of the Brush arc generators. Several handsome illustrations help to make the pamphlet a very attractive publication. The first Brush arc generator, which was built in 1877, is depicted, as well as some of the different types and installations of the modern machines. Several arc plug switchboards are also illustrated. A list of 45 companies using large Brush arc generators of 480-light capacity and above, in 1899, indicates that the Brush machines are still attractive to the public.

The Western Electrical Supply company of St. Louis has recently issued two pamphlets, illustrating some electrical novelties which are thoroughly practical and seem to fill a long-felt want. One illustrates the Ever Ready dry-battery lamps, which are made in the form of interior searchlights, elec-

tric gas-lighters, dental lamps, night-lamps, candles, etc. The other pamphlet illustrates small storage-battery lamps, whose battery can be recharged from any incandescent circuit. These lamps are adapted for use as bicycle, photographer's, carriage and watchman's lanterns. They would seem especially serviceable in any place where it would be dangerous to carry an exposed light. The pamphlets are mailed on application.

ELECTRICAL SECURITIES.

The Chicago City Railway company has declared its regular quarterly dividend of three per cent., payable on September 30th to stockholders of record at the close of business on September 15th. The books will be closed from September 16th to September 20th, both inclusive.

The directors of the Union Elevated Railroad company of Chicago have declared a four per cent. dividend to stockholders of record on August 25th. This is the company operating the elevated-railway loop, and the dividend is the first to be declared. It was a flat dividend of four per cent., and was not for any specified period. It is said to be the intention to pay dividends regularly at the rate of four per cent. a year, providing earnings are maintained at the present rate. Mr. Yerkes is credited with owning a majority of the capital stock of the company. There is outstanding $5,000,000 of capital stock.

MISCELLANEOUS.

Ray S. Wait, H. W. Hawkins and C. L. Hawley are the incorporators of the Guarantee Electric company of Chicago, capitalized at $50,000.

The Association of Electrical Contractors of Pittsburg and Western Pennsylvania is arranging to hold a banquet about the middle of September. The association, which has been formed less than a year, has been very successful, and now includes every contractor in Pittsburg and nearly every contractor in Western Pennsylvania.

The Treasury Department, through the supervising architect, is inviting sealed proposals, until October 2d, for all labor and materials required for the electric work in the main building at the United States immigrant station, Ellis Island, New York harbor. Drawings and specifications may be had upon application to the department at Washington, D. C., or to Boring & Tilton, architects, 32 Broadway, New York.

The Liquid Air, Power and Automobile company of Boston, whose advertisements in the daily papers have attracted so much attention, says that it has purchased the five-story and basement brick factory corner Massachusetts avenue and Albany street, Cambridge, held under a lease for some time past. The building is 50 by 200 feet, giving the company altogether about 1 1-3 acres of floor space, with ample room for the conduct of the business of manufacturing liquid air and automobiles and other machines run by liquid-air power.

The Elevator Conductors and Starters association of Chicago desires the City Council to enforce the laws bearing on safety appliances in public elevators and also providing for an elevator-examining board, to be appointed by the building commissioners, and to consist of one elevator man, one liability underwriter and one building inspector. This action on the part of the association is said to be due to the numerous elevator accidents that have recently occurred. It is contended that the accidents are directly traceable to two causes. The first is the lax enforcement of the safety-appliance ordinances and the second is the employment of inexperienced and incompetent hands to run the elevators. The automatic single and double doors in use in many of the new elevators are specially condemned as a constant menace to public safety. Skilled operators complain that these doors cannot be closed until the elevator is started up or down. Hasty and unthinking people, they say, in spite of every warning, will insist on rushing through an open door, no matter where it leads them.

TRADE NEWS.

The British Westinghouse Electric and Manufacturing company will build gas and steam engines as well as electrical apparatus.

The McDougall Storage Battery company of New York city, with a capital stock of $1,000,000, has been incorporated under the laws of West Virginia.

The General Electric company reports that its business so far this year has averaged over 60 per cent. greater than for the corresponding period of 1898.

The American Electric Wire company of Chicago has been incorporated, with a capital stock of $5,000, to manufacture electrical devices, apparatus and supplies. The incorporators are Charles B. Stafford, Samuel Wilson and Isaac M. Crane.

The St. Louis office of the General Incandescent Arc Light company, removed from the Security building to 638 Century building, will hereafter be known as a sales office of the "G. I." company, instead of a branch of the Martin J. Insull company.

The E. P. Allis company of Milwaukee, Wis., commencing on September 1st, has granted a uniform increase to employes working by the hour of five per cent. The increase does not apply to employes working on a salary or those under contract, but is said to affect most of the men on the pay roll, who number approximately 2,000.

A feature of the National Export Exposition that is to be opened in Philadelphia on September 14th will be an exhibit by the International Correspondence Schools, Scranton, Pa., illustrating their method of teaching by mail. The bound volumes of their instruction and question papers, as well as work done by students, including numerous drawing plates, may be inspected by visitors, and a representative will be in charge to give full particulars.

George R. Hamlin, the Washington patent attorney, has a pretty well-founded theory that many practical men working on moderate salaries do not patent their inventions simply because they cannot afford to pay the attorney's fee in a lump sum in advance, as usually required. Mr. Hamlin overcomes this difficulty by making his fee payable in installments, and inventors of moderate means having new wrinkles in electrical apparatus will find his free illustrated booklet, "Information for Inventors," interesting reading.

Under the name of Manning, Maxwell & Moore, with head office in New York, a consolidation has been effected of the following-named companies: Consolidated Safety Valve company (safety valves), New York; Shaw Electric Crane company (electric traveling cranes), Muskegon, Mich.; Hayden & Derby company (injectors), New York; Pedrick & Ayer company (railway and machinists' tools, compressors, etc.), Philadelphia; Ashcroft Manufacturing company (gauges, indicators, etc.), New York; Manning, Maxwell & Moore (general sales agents), New York.

BUSINESS.

Gates & Randolph, 13 Monadnock block, Chicago, report the recent sales of 45 Triumph generators, aggregating over 2,000 kilowatts, and 20 motors, aggregating about 200 horse power. The apparatus was manufactured by the Triumph Electric company of Cincinnati.

The George C. Towle Manufacturing company of Lancaster, Pa., the well-known fan manufacturing concern, has just increased its facilities for manufacturing its line of small power motors. The company has received quite a number of foreign orders lately for the motors, which speaks well for these machines and the company's increasing business. A specialty is made of motors built to order where special designs are required.

The Western Electric company of Chicago is agent for hot-wire ammeters and voltmeters made by the Stanley Manufacturing company. These instruments are for either direct or alternating current and are made for switchboard work or portable use. They are said to be accurate and dead-beat, to possess a wide range of adjustment, and to be invaluable for general central-station use. The company also announces that it has recently placed upon the market a marine type of the Petite enclosed-arc lamp that is suitable for shipyards and lake vessels.

The Central Electric company, Chicago, reports further sales of Bullock generators and motors and is much pleased at the increasing interest that is being shown in this apparatus. The Bullock Electric Manufacturing company is now building generators for railway and power work up to 800 kilowatts, and the contracts for this type of machinery up to the present time have been very gratifying. While taking advantage of its unsurpassed factory facilities to turn out this heavier class of apparatus, yet the smaller lines are given the closest possible attention by the company, and those having in mind the installation of lighting plants will find it to their benefit to state their requirements to the Central Electric company, sales agent for the Bullock Electric Manufacturing company.

Those in the electrical business having business relations already established with firms in foreign countries will be interested to know that the Polyglot company of 120 Liberty street, New York, is in the novel business of making translations on scientific and technical subjects, such as foreign price-lists, catalogues, etc. The company also makes a specialty of patent translations. Following is a list of the more important languages which the Polyglot company translates: English, German, French, Spanish, Italian, Russian, Swedish, Norwegian, Danish, Portuguese, Hungarian, Chinese, Arabic, Japanese; but the company is prepared to handle, to quote its own words, translations "from and to all commercial living languages." The Polyglot company was an inspiration of its present manager, Mr. Jean A. Wetmore, M. S., E. E. Mr. Wetmore is no stranger to the electrical fraternity; in fact, he was known for 10 years as "the exponent of high-grade insulation and father of paper insulation." Mr. Wetmore is an extensively traveled gentleman, known not only in the United States, but to foreign countries as well. He has also an extensive acquaintance in Cuba and Mexico. Now that the United States has extensive interests over sea, the value of such services as are now offered by Mr. Wetmore is apparent to the managers of every large electrical concern. It is safe to say that communication with the Polyglot company will in most cases result in the establishment of relations that will be entirely beneficial.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 29, 1899.

631,768. Electric Motor. John Anderson, St. Louis, Mo., assignor of one-half to Patrick H. Clarke, St. Louis, Mo. Application filed September 19, 1898.

There is combined with a car truck and track wheels thereof an electric motor, an armature shaft for the same, short shafts forming a continuation of the armature shaft, couplings for removably securing the shafts together, bearings in the truck frame for receiving the free ends of the short shafts, a frame to which the motor is removably secured and disks adapted to co-operate with the track wheels for rotating the latter by frictional contact.

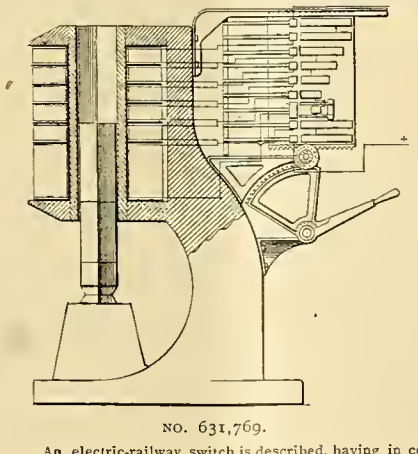
631,769. Electric Hammer. John Anderson, St. Louis, Mo., assignor of one-half to Patrick H. Clarke, St. Louis, Mo. Application filed September 19, 1898.

The hammer comprises a suitable standard, a hollow-core electromagnet, supported by the same, a series of coils comprising the electromagnet, a vertical reciprocating hammer movably located within the core, and forming an armature, and a suitable switchboard, and wires leading from the switchboard to the coils for controlling the electrical current through the electromagnet, whereby upon the movement of the switchboard the upper coils are successively and collectively energized, until the armature is completely raised, and afterward the lower coil is energized, causing the hammer to be drawn downwardly and render a sufficient blow. (See cut.)

631,786. Space Block for Laminated Armatures. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed December 15, 1898.

The combination with a lamination in a dynamo-electric machine of ribs secured to the lamination by means integral with the ribs and lamination.

631,791. Electric Switch. John W. Hearn, New York, N. Y. Application filed February 7, 1899.



NO. 631,769.

An electric-railway switch is described, having in combination with two switch magnets armatures indirectly connected with the switch point for moving the same in opposite directions, and a movable contact connected with the magnets for alternately exciting the same, the contact consisting of a solenoid and an armature arranged to move the contact arm from one contact pin to the other.

631,796. Storage Battery. Harry H. Kneper, Chicago, assignor to the American Electric Vehicle company, Chicago. Application filed June 27, 1898.

The battery has a series of accumulator plates and an envelope for inclosing each of the plates, the envelopes comprising a sheet of absorbent material wrapped about the faces and edge of the plate, and a cap of absorbent material separate from the sheet and fitting over the end of the plate.

631,810. Separator for Accumulator Plates. Harry G. Osburn, Chicago, Ill. Application filed October 26, 1898.

A separator formed of a plate or sheet of non-conducting material having upon one face a series of channels, and upon the other face a series of channels angularly arranged relatively thereto, to leave at intervals transverse fluid paths through the plate.

631,816. Electric Arc Lamp. George C. Pyle, Indianapolis, Ind., assignor of one-half to Frank H. Ewers, Indianapolis. Application filed December 24, 1898.

An arc lamp including a frame with a suitable supporting arm therefrom, a guide bar carried by such arm, an electrode slidably carried on the guide bar, a clutch for supporting the lower end of such electrode, a lever mounted in the frame, a connection from one side of such clutch to the lever, and a solenoid for actuating the lever, whereby one side of the clutch will be elevated.

631,839. Process of Manufacturing White Lead or Other Pigments By Electrolysis. Herman C. Woltereck, New York, N. Y. Application filed December 16, 1898.

The process consists in passing an electric current from a lead anode through an electrolyte capable of dissolving lead and containing an alkali metal bicarbonate, maintaining the electrolyte at a temperature below 25 degrees centigrade, continuously withdrawing the mixed electrolyte and precipitate from the electrolytic vat, removing the white lead therefrom by filtration, introducing carbon dioxide into the filtrate and returning the regenerated electrolyte to the electrolytic vat.

631,854. Trolley-pole Retriever. Daniel E. Lesser, Warren, Pa., assignor of one-third to Phillip G. Wheeler, Warren, Pa. Application filed June 15, 1898.

A trolley-pole retriever is described comprising a standard, a shouldered weight within the standard, an arm, a cord fastened at one end to the standard at a point above the upward limit of travel of the weight and passing beneath a guide sheave and from thence attached to a trolley pole to provide a permanent allowance of slack.

631,864. Coupling for Electric or Other Wires. Rolland Thompson, Passaic, N. J., assignor of one-half to John Dunphy, New York, N. Y. Application filed June 23, 1899.

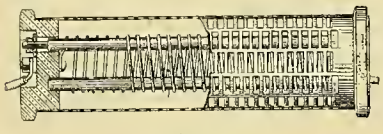
The coupling comprises wires having hoop-shaped extremities containing shoulders extending upwardly from the upper sides of the wires, and a split sleeve containing a slot to engage the hooks and having its upper portions adapted to fit around the ends of the wires, and its lower side portions extending around and fitting between the ends of the wires and forming a flush lower side therewith.

631,869. Signal Mechanism. Gardiner B. Gray, Crafton, Pa. Application filed May 6, 1899.

The mechanism combines a signal, having a bias to danger position, electrically controlled mechanism for locking the signal at clear position, and two independent circuit breakers controlled by train movements for controlling the signal-locking mechanism, the circuit breakers being simultaneously operative to release the signal from clear position.

631,871. Electrical Measuring Instrument. Edward W. Jewell, Chicago, Ill. Application filed February 4, 1899.

An instrument is described having a field magnet, removable pole pieces fitting the ends thereof, framework in which the pole pieces are rigidly mounted, a measuring coil rotatably mounted between the pole pieces, a core rigidly held in place between the pole-pieces and encircled by the coil, and springs connected with and opposing the rotation of the coil, the pole pieces, framework, coil and springs thereby constituting a unit which may be adjusted upon or removed from the ends of the magnet as a single piece.



NO. 631,959.

631,888. Electric Gas-lighting Apparatus. William E. Cram, Boston, Mass. Application filed January 7, 1898.

A gas burner, having a valve, a vibratile igniting device, a magnet included in an igniting circuit, a single armature for controlling the valve and having connections for actuating the igniting device in one direction, a switch having a position in which it makes and maintains contact between the electrodes of the igniting circuit, and a thermostatic device adapted to break the igniting circuit at the burner, under the influence of the gas flame, while contact is still maintained at the switch.

631,892. Electric Push-button. Louis F. Johnson, Easton, Pa. Application filed May 29, 1899.

A push button and a case are described, the button having a flange or head with a straight bevel upon its inner side, and a corresponding bevel upon the case to form a close joint when the two bevels come together.

631,917. Signaling and Controlling Apparatus for Motor-vehicles. William R. Wynne, London, England. Application filed March 30, 1899.

A controller for electric motors combining a controller drum, a handle for rotating the drum which is also capable of a vertical movement, a rod sliding within the axle of the drum, means connecting the rod and handle whereby a vertical movement of the handle causes a similar movement of the rod, and an electric switch governed by the rod.

631,919. Electric Motor. Riccardo Arno, Turin, Italy. Application filed March 5, 1898.

A method of starting asynchronous monophase alternating-current motors, which consists in inserting a suitable resistance in the rotor coils and momentarily rendering the coils of the rotor unsymmetrical and gradually cutting out the resistance.

631,959. Electric Heater. Edward E. Gold, New York, N. Y. Original application filed January 8, 1898. Divided and this application filed January 7, 1899.

An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, and a support therefor consisting of a plurality of rods extended within the helix, of materially smaller diameter than the interior thereof, so that the helix is interiorly open for free circulation of air within it, the rods supporting the convolutions of the helix by tangential contact therewith each at a single point only of their circumference. (See cut.)

631,965. Electric Arc Lamp. Moses S. Okun, New York, N. Y. Application filed October 23, 1895.

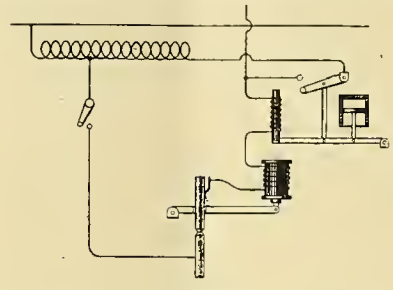
The lamp has a carbon-feeding mechanism comprising a lever, a spring-acting drum carried thereby, a flexible connection wound on the drum, a brake lever to control the movement of the drum, an abutment to act on the brake lever, the abutment being located adjacent to the pivot of the first-mentioned lever, the end of the brake lever that is opposite its end which acts on the abutment being arranged to act on the drum, a carbon holder carried by the connection, and means for operating the lever by the passing of a current.

631,970. Electric Terminal. Ferdinand Schwedtmann, St. Louis, Mo. Application filed February 27, 1899.

A binding-post or terminal for electric-line wires is described, formed from drawn-metal tubing, having a portion thereof flattened to adapt it for contact with an electrical instrument, and a portion thereof cylindrical to receive the line wire.

631,975. Means for Operating Electric Arc Lamps. Herbert A. Wagner and Denney W. Roper, St. Louis, Mo. Application filed May 25, 1899.

In an electric arc-lighting system, the method of heating the carbon tips by a reduced current, and then altering the connections of the circuit to permit the flow of normal current and the normal operation of the lamp. (See cut.)



NO. 631,975.

632,004. Electrical Warp Stop Motion. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J., assignors to the Kip-Armstrong company of New York. Application filed October 25, 1898.

For this warp-stop motion for looms are mentioned the following features: A series of metallic drops each having a thread aperture, an elongated guide slot, and a contact projection between the thread aperture and slot, an electric circuit having two terminals which extend through the guide slots in the series of drops, an electromagnet mounted on the shipper lever and in the circuit, the shipper lever, the lay and means whereby the shipper lever is shifted to stop the loom by the lay, when the circuit is closed by the falling of one of the drops onto the upper circuit terminal.

632,019. Controlling System for Electric Motors. Frank A. Merrick, Johnstown, Pa. Application filed March 27, 1899.

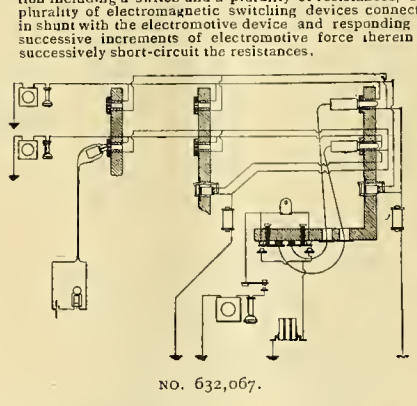
A controller for electric motors, having a plurality of separately actuated contacts for varying the motor speed, separate electromagnets responsive to different current conditions for controlling the respective contacts, a circuit including a plurality of such contacts and a manually operated master controller comprising controlling means for changing the current conditions in such circuit.

632,033. Trolley. Charles L. Weyand, New York, N. Y. Application filed April 29, 1899.

A base having rearward teeth, a vertically swinging trolley pole journaled in the base and carrying a latch or pawl adapted to engage the teeth are in combination with an electromagnetic device controlling the latch or pawl, and itself controlled by the current from the line wire.

632,039. Automatic Controlling System for Electromotive Devices. John B. Blood, Newburyport, and Frank A. Merrick, Newton, Mass., assignors to Blood & Hale, Boston, Mass. Application filed July 11, 1898.

The combination with an electric-supply circuit, an electromotive device connected thereto through a connection including a switch and a plurality of resistances, of a plurality of electromagnetic switching devices connected in shunt with the electromotive device and responding to successive increments of electromotive force therein to successively short-circuit the resistances.



NO. 632,067.

632,046. Telegraph Register. Edward B. Ellicott and Louis E. Oehring, Chicago, Ill., assignors to the Western Electric company, Chicago. Application filed September 15, 1898.

The invention combines electromagnetic printing mechanism, a tape-feeding gear train, an escapement therefor, a stop adapted to engage with a moveable part of the train or escapement to prevent the operation thereof, a spring adapted to disengage the stop and thereby to release the gear train, and means operated by the electromagnetic printing mechanism for controlling the operation of the spring.

632,052. Switch for Trolley Wires. Alexander F. Humphrey, Allegheny, Pa. Application filed November 10, 1898.

The switch has a supporting plate, a series of rails formed integral with the underneath face of the plate, a switch tongue pivotally connected to one of the rails, a pair of guides formed integral with the upper face of the plate and adapted to receive between them the trolley wires, and means for securing the wires in position.

632,058. Incandescent Electric-light Bulb. Ross Mossgrove, Jr., Steubenville, O., assignor of one-half to Emmett McD. McKee, Steubenville, O. Application filed November 26, 1898.

A blown molded-glass bulb for incandescent electric-light lamps produced complete with longitudinal corrugated walls having the natural vitreous polish and brilliancy of the glass.

632,066. Telephone-exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago. Application filed December 18, 1888.

The combination with two telephone lines, each provided with a different connecting piece on each of two or more switchboards, and each permanently connected to ground through its individual polarized annunciator, of a connection between the lines at one of the boards and a battery closed in derived circuit through the annunciators to hold them in position to prevent false signals.

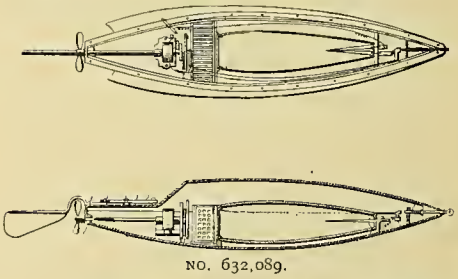
632,067. Multiple-switchboard System. Charles E. Scribner, Chicago, Ill. Application filed November 14, 1891. Renewed November 16, 1896.

A telephone line extending from earth at a substation to earth at a central station, line terminals at the central station connected together in parallel and an indicating device and a retardation coil included in the line are combined with circuits and contact pieces adapted to short-circuit the indicating device when a connection is made to line. (See cut.)

632,076. Electric Switch. Albert E. Wells, Pittsfield, Mass., assignor of one-half to Chauncey A. Cornell and William J. Baughman, Pittsfield, Mass. Application filed February 7, 1898.

An electric switch provided with a terminal block box having a cover with a slot registering with a slot in one side of the box proper, and a two-armed shutter within the box and having one of its arms pivoted on the inside of the box, the arms of the shutter being adapted to close the slots.

632,089. Automobile Torpedo. Thomas E. Barrow, Mansfield, O., assignor of one-half to Louis J. McCray, Mansfield, O., and Henry L. McGray, Ashland, O. Application filed July 11, 1898.



NO. 632,089.

A submarine automobile torpedo is described consisting of an outer and inner case, an electric battery situated in the rear of the inner case, a motor to propel the torpedo located in the outer case and operated by the battery, and a mechanism to complete a circuit when a torpedo strikes an obstruction to explode the charge in the inner case, consisting of a spring-actuated bolt movably secured in the forward end of the outer casing, a lever adapted to be contacted by the bolt, and two igniting points located in such a manner and connected with the battery so that when the lever is struck by the bolt, the lever contacts one of the igniting points and makes an electrical circuit to ignite a charge in the inner case. (See cut.)

632,106. Visual Signal Apparatus. Rudolf Einbigler, New York, N. Y. Application filed March 29, 1899.

In a visual signal, a main signal plate mounted to swing, an electromagnet for operating the plate in one direction, an electromagnet for operating the plate in the opposite direction, an electric circuit in which the magnets are located, a main circuit-closing device for controlling the magnets, an auxiliary signal normally hidden or covered by the main signal plate, and an electric circuit in which the auxiliary signal is arranged, the circuit being manually controlled from a point remote from the controller of the main signal circuit.

632,144. Electric Meter. Albert Peloux, Geneva, Switzerland. Application filed December 16, 1898.

An electric meter comprising stationary field coils arranged in the measuring circuit, and stationary shunt coils consisting of individual sections, a rotary armature comprising pieces of magnetic material energized by the shunt coils during the rotary motion, and current switching devices operated by the movement of the armature, for inserting the shunt-coil sections into the circuit successively.

632,145. Time Switch. Henry S. Prentiss, Elizabeth, N. J. Application filed February 13, 1897.

A time switch embodying the usual switch lever cooperating with contacts for making and breaking the circuit, a spring-pressed lever adapted to engage with the lever for turning the same about its pivot to break the circuit, a latch adapted to engage with and to retain the lever in its operative position, an electromagnet having its armature placed in connection with the latch for tripping the same to release the switch-operating lever when the electromagnet is energized for the purpose of turning the switch lever to break the circuit, and a circuit-closer in the circuit of the electromagnet.

632,211. Electric-conductor Support. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston. Application filed July 2, 1897.

A support for electric conductors is described

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, SEPTEMBER 16, 1899. No. 12

MUNICIPAL ELECTRICIANS.

Convention at Wilmington Last Week—Proceedings in Detail.

With all due respect to those large and time-honoured convention cities, Chicago and New York, it may now be safely put down as a fact that for genuine interest and enthusiasm in electrical conventions the smaller cities are voted by the majority of those who attend to be the favorites. In fact, nowadays, at electrical gatherings of this sort the remark is often heard: "Give us a smaller town for an electrical convention." So it will be no surprise to many familiar with such gatherings to learn that Wilmington was indeed in holiday attire.

The opening of the exhibition on Monday evening, September 4th, was reported by telegraph in the Western Electrician of last week. On Tuesday morning the first business session of the convention was held in the Grand Opera House. It was well attended, not only by the delegates, but by many citizens of Wilmington, who were admitted to the house without tickets. The interior of the theater was attractively decorated. Bunting, rosettes and flags were tastefully arranged about the balcony railing, and in front of the stage were the words, "What Hath God Wrought," in incandescent lights.

After a musical selection Bishop Coleman offered prayer, and then Mayor Fahey of Wilmington welcomed the delegates. The mayor said that he regarded the convention as a most important event. "In your deliberations," said he, "you will aid us to obtain a more perfect knowledge of the application of electricity in municipal administration and in the exchange of views and the demonstration of newly conceived theories your work will prove of inestimable value. One of the greatest objects of municipal government is the protection of life and property and the prevention of crime, and the municipal electrician, in the accomplishment of this object, has become an important factor in every well-organized city." The mayor spoke appreciatively of the efforts of Mr. Satterthwaite of the Wilmington Board of Trade and Mr. Aydon, the city electrician and president of the association, to make the convention and exhibition a success.

Governor Tunnell, the next speaker, expressed, in graceful phrase, his sense of the importance of the work of the association. He concluded with this sensible statement: "I have not a single fact to state, or a single statistic or a single figure. In matters of electricity, its use and development, I am not a well-informed man. I again welcome you and wish you a most pleasant and successful session."

Mr. H. C. Conrad, the city solicitor, also made a happy speech.

Morris W. Mead of Pittsburg responded for the association.

President Aydon's Address.

Mr. Aydon reviewed the brief history of the organization. He referred to the invention of the telegraph and the telephone, the electric light and the electric railway, and praised the work of Morse, Bell, Edison, Daft, Vandepoele and Sprague. He then continued:

"The novelty of Morse's invention had hardly time to dim before a new electric field was developed. The birth of the telegraph originated the idea of municipal fire protection by electric signaling. But six years had elapsed when Dr. Channing of Boston published a description of the method of using the telegraph for the protection of life and property.

"Before this time cities were districted and a watch-tower provided for each district, and watchmen were on duty at all hours. At the sight of smoke or flame, or if told of a fire, the watchman would strike upon his bell the number of his district. This is the way they do in Japan to-day, but the Japs are advancing along these lines and are already preparing to modernize this work.

"In 1851 the city of Boston—leader in all great enterprises, as she is—took up the matter of fire protection and voted $10,000 for the experiment. So with Dr. Channing, resourceful in ideas, and Moses G. Farmer, recognized as the most expert electrical mechanic of that day, the fire-alarm telegraph system as we now have it was developed and made practical.

"Then came Gamewell, indomitable, persistent, a born organizer, to whose able management is due the fact that 90 per cent. of all municipal fire-alarm business of the United States is done by the company bearing his name. The names of Channing, Farmer and Gamewell stand high on the roll of municipal fire-protection fame.

"Fire, while one of man's most useful agents, is also his greatest enemy. So appalling is the annual destruction of life and property that the genius of mankind has been aroused to encompass its effect. It is not enough to know that a fire has broken out in a certain district; but the building, aye, the very room, the dangerous heat or incipient flame must be known.

DELEGATES AND VISITORS AT THE MUNICIPAL ELECTRICIANS' CONVENTION.

"Great has been the struggle to arrive at this result. Devices upon devices have been originated, until our Patent Office became a thermostatic Mecca for the inventors of such devices. More or less meritorious have they all been, and some have maintained a commercial status, but the great bulk have gone like 'Ships that Pass in the Night.'

"A manual auxiliary fire alarm that would reliably give the desired results was found, and gave rise to what is known as the Gamewell auxiliary fire-alarm return call-box system. This, operated in connection with the street fire-alarm boxes, greatly extended and perfected the area of municipal fire protection. Automatic devices there were, but none possessing that element of continuous reliability so necessary to the proper advisement of actual danger or fire. It was Chief Bonner of New York who said: 'Given advisement of a fire in the first five minutes, I will put it out in the next five;' and now all this is possible; and to-day, as a human being is equipped with a nerve center and nerves radiating therefrom, wherein every part of the body is sensitive to touch, so any building can be equipped with a similar nerve

center and radiating nerves, so sensitive to dangerous heat or flame as to be able to signal a warning to a common center without delay, so that the first minute will not have elapsed before the warning is given, both locally and centrally.

"This is accomplished by the Montauk multiphase cable, the last great electrical invention of the nineteenth century, and in many respects the greatest, because of its saving of human life and protecting business from serious interruptions.

"In the construction of this cable a natural law was availed of, and the conditions are such that when dangerous heat or incipient flame are in proximity thereto, the action of the cable is immediate, electrically sealing, thus closing the circuit, as a telegraph operator would his key, for sending the signal to the desired points. By it every building, of whatever character and wherever located, may be vitalized and have its own fire and police protection. Suburban homes, suburban factories, all buildings in or beyond the environment of the municipal fire department by the use of this Montauk multiphase cable are enabled to have their own fire-alarm systems."

President Aydon concluded by enjoining the members of the association to put forth their best efforts, both for the municipalities they serve and the national organization.

Tuesday Afternoon Session.

In the afternoon an invitation was received from C. R. Van Trump, superintendent of the Wilmington City Electric company, to visit the plant of that company. Then Captain William Brophy of Boston read a carefully prepared paper on "The Licensing of Employes on Electrical Work and Improving the Quality of Work and Material." He dwelt on the advantages of a licensing system and the need of good construction. The paper was discussed by Messrs. Mead of Pittsburg, Pillsbury of Minneapolis, Flood of Boston and Mason of Brooklyn.

Clinton R. Woodruff of Philadelphia, secretary of the National Municipal League, addressed the association on "Municipal Government."

Following this address, G. F. Macdonald of Ottawa, Ont., read a paper on "The Progress and Development of the Police and Fire-alarm Telegraph in Canada." Mr. Macdonald's paper abounded in interesting statistics.

Wednesday's Sessions.

The first paper of Wednesday was on the "History of the Police Telegraph System," by John Weigel of Boston. Mr. Weigel pointed out the great advantage of electrical signals in policing cities.

In the absence of W. H. Thompson of Richmond, Va., his paper on "Overhead Construction" was read by the secretary.

Thomas W. Flood, commissioner of wires in Boston, read an interesting paper on "Laws and Government of the Wire Department of Boston." He spoke of the good work which had been accomplished by the wire inspectors in Boston. There was a time when shoddy material and poor work was done, but the concerns which did such work have now been compelled to go elsewhere to dispose of their stuff.

J. O. Leary of the Telegraphers' Benefit association addressed the meeting in the interests of that body.

Morris W. Mead of Pittsburg presented a paper on the centralization of electrical departments under one head. Mr. Mead took the position that the electrical departments of a city government should be under one head to make them easy of control.

A number of new members, including several honorary members, were elected.

On the invitation of Mr. Mead, the association voted to meet in Pittsburg next year. The date of the gathering was left with the executive committee.

Frank C. Mason was elected delegate to the Electrical Congress in Paris next year and also director of next year's exhibition.

Thanks were extended to the press, the citizens, to President Aydon and all who had assisted in making the convention a success.

New Officers.

Officers were elected on Wednesday afternoon. Comparatively few changes were made, and the new list is as follows:

President—William Brophy, Boston.
Vice-president—G. F. Macdonald, Ottawa, Ont.
Treasurer—Adam Bosch, Newark, N. J.
Secretary—Henry Cottell, Boston.
Financial secretary—Barrett McAllister, Bradford, Pa.
Executive committee—Morris W. Mead, Pittsburg; W. Y. Ellett, Elmira, N. Y.; J. W. Aydon, Wilmington, Del.; F. C. Mason, Brooklyn, N. Y.; Frank G. Boyd, Baltimore.

A portrait of Captain Brophy, the new president, is given herewith. The recipient of the highest honor in the gift of the association was born in Ireland, but he is an American in thought and feeling, having been brought up in this country. He is the chief electrician of the Boston Wire Department. A brief sketch of President Brophy's career was given in the Western Electrician of September 2d.

Social Features.

The visitors were pleasantly entertained at the exhibition by trolley rides to Shellpot Park and the Delaware River and to Brandywine Springs. There was also a parade and review of firemen and policemen, a trip around the city of Wilmington and a boat ride on the Delaware River.

A feature of the steamboat ride of Thursday was the presentation of a gold-headed cane to Mr. Aydon, the retiring president. Mr. Mead made the presentation speech. On the return trip Mrs. George B. Moore, on behalf of the ladies' reception committee, presented to Mr. Macdonald of Ottawa a beautiful United States flag of silk. Mr. Macdonald, not to be outdone, gave to the city of Wilmington a gold seal with the arms of the city of Ottawa cut upon it.

Attendance.

A partial list of those in attendance is given: From New York, William C. Callmaun, T. J. Smith, F. W. Harrington, Edward Baines, Ditman Fisher, E. E. Pierce, George T. Manson, Fred Hende, A. P. Eckert, Marcus Nathan, G. F. Porter, G. L. Wiley, C. W. Price, Frederick Pearle, Alexander Henderson, M. J. Leary, Charles W. Price, J. B. Taltavall; Boston, F. W. Ferrin, A. S. Clark, John Weigel, Thomas. W. Flood, John D. Cornady, William Brophy; Brooklyn, Newton H. Murphy, F. C. Mason, Michael E. Dougherty, W. A. Cooper, Baltimore, S. A. Williams, F. G. Boyd; Minneapolis, Charles K. Pillsbury, Z. L. Morrison; Bridgeport (Conn.), William A. Bauer, Mrs. Bauer and the Misses Eva and Emma Bauer; Elmira (N. Y.), Al-

WILLIAM BROPHY, PRESIDENT NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.

bert Bundy, W. Y. Ellett; Chicago, Charles A. Rolfe, F. L. Perry; Savannah (Ga.), W. D. Claiborne; Ottawa (Can.), G. F. Macdonald; Paterson (N. J.), J. F. Zeluff; Newark (N. J.), Adam Bosch; Pittsburg (Pa.), M. W. Mead; Utica (N. Y.), G. F. Breitenstein; Peoria (Ill.), F. L. Michael; Corning (N. Y.), F. P. Foster; New Brunswick (N. J.), Charles Greenwalt; Charleston (S. C.), Lon Simmons, Arthur R. Rhett; Richmond (Va.), W. H. Thompson; Trenton (N. J.), W. G. Tingley; Chester (Pa.), W. S. Sykes; Toledo (O.), J. T. Greene, William Mayo; Harrisburg (Pa.), E. H. Diehe; Wheeling (W. Va.), J. C. Dunaway.

Notes of the Electrical Exhibition.

Clarence E. Stump was one of the most warmly welcomed arrivals on Tuesday.

Who said there was "a hole in the wall" on opening night at the electrical exhibition?

General Manager George F. Porter did the honors, in the absence of W. R. Brixey, for Day's Kerite.

It was a matter of regret that William Roche did not himself appear, but Fred Pearce made a good representative. But where was Roche?

Morris & Co., electrical supplies, Wilmington, Del., showed full lines of their various specialties, switches, fuses, etc., and also a very handsome Rushmore searchlight.

The John A. Roebling's Sons company of New York and Trenton, N. J., made a handsome exhibit, and its two representatives, F. W. Harrington and N. G. Tingley, were always on hand.

Frederick Pearce and Walter H. Pearce looked after the interests of Pearce's electric turntables and the Pearce signal system. Mr. Pearce's headquarters are now at Nos. 18 to 20 Rose street, New York.

President J. Jones, of the J. Jones & Son company, couldn't resist the temptation, and although his company made no exhibition, he turned up smiling Tuesday to mingle with the boys at the Wilmington convention. Mr. Jones has recently brought out a new lamp, the Radiant, that is said to be meeting with great success. Mr. Jones would find quite a market for this lamp in the West did he but push it aggressively in that section.

C. P. Platt, "the ubiquitous," of American telephone fame, passed through Wilmington at the time of the convention. Mr. Platt reports a booming telephone business and says his company, the American of Chicago, was never so rushed.

W. C. Banks appeared for the Gordon Battery company of New York. Mr. Banks made a very attractive exhibit of his cells, arranging them in a sort of a pyramid, so as to illustrate, in the most convincing manner, many fine points of this now most popular battery.

Manager T. J. Smith of the Manufacturers and Inventors' company, No. 96 Fulton street, New York, made a handsome exhibit. His "Morse watch" for train-dispatchers', railway-station, military-telegraph, inspectors' and lineman service, attracted no little attention.

It was a matter of great regret that General Manager Leonard F. Requa of the Safety Insulated Wire and Cable company could not appear in person, owing to the immense business his company is now handling. Mr. Requa was represented by Avery P Eckert. The company made a very neat exhibit of various styles of safety cables.

One man who was cordially welcomed was Manager Marcus Nathan of the New York Electrical Exhibition of 1899. It will interest Mr. Nathan's many friends to know that his services have been secured for a coming exposition, and one of the largest outside of the electrical line that New York has ever seen.

Garrett, Miller & Co. made a most creditable exhibit as manufacturers of telephone apparatus. This concern has its factory in Wilmington, and also handles general electrical supplies, such as Buckeye and Jandus lamps, etc. These latter specialties, as well as samples of telephone equipment, were presented at the exhibition at Pyle's Academy.

President Jos. W. Stover of the Gamewell company did not disappoint his many friends. He turned up on Tuesday and was warmly welcomed. It would have been a pity had Mr. Stover not appeared, for the Gamewell exhibit was one of the most important at the exhibition, and in addition to this the Gamewell company had a friend in almost every delegate present.

The Arrowsmith Electric company, Wilmington, Del., presented a novel electrical sign or "curiosity exciter," in the form of a figure of a pretty little girl that was at intervals illuminated by the quick flashing of groups of tiny and different-colored electric-light bulbs. This concern also made a specialty of the exhibition of Paragon fans and also many different styles of electroliers.

One remarkable thing in connection with the exhibition was the fact that everything was in shape for the opening. There was not an exhibit which was not in place. Much of the credit for this work is due to Frank C. Mason, who devoted his time and attention for over a week to getting the exhibits in shape. In this he succeeded, and on the opening night he was congratulated on his work by the delegates and many others present who knew him.

It is safe to say that no Municipal convention is ever without a handsome exhibit of the Gamewell Fire Alarm and Telegraph company of New York. This time the exhibit was in charge of A. L. Tinker. President J. W. Stover was daily expected. The Gamewell company exhibited its usual line of high-class fire-alarm telegraphs, police telegraphs and auxiliary fire alarms. While it is impossible to describe this exhibit in detail, it may be said that it occupied practically the entire head of the room in Pyle's Academy. Mr. Tinker made many friends in the interest of his company.

Manager William C. Callmaun and Inventor Edward Baines were enterprising enough to secure one of the most prominent spaces in Pyle's Academy in which to present in actual operation a set of Baines' improved primary batteries. As the Baines battery is a new type of the gravity blue-stone order, Mr. Callman's good taste in selecting white as the predominating color and background of his booth excited favorable comment; in fact, the exhibit was a very pretty one as well as most practical. A description of the interesting claims made for this improved cell is presented elsewhere in this issue.

F. M. Ferrin of No. 7 Arch street, Boston, appeared in company with Treasurer A. T. Clark of the American Circular Loom company, and talked municipal cables, also aerial, underground and submarine. Mr. Ferrin is sole manufacturer of the woven-covered cables. The American Circular Loom company, through Mr. Clark and New York Representative James L. Kirkland, made a tasteful exhibit of its well-known flexible tubing, something similar to that at the late New York electrical show. The National India Rubber company also made an exhibit.

Captain Candee of the Okonite company and Charles W. Price of the Electrical Review came down with the New York delegation. It may be said that almost all the Okonite force was on hand, for Messrs. Manson and Secretary W. H. Hodgins were included in the contingent that was on hand in full dress on Tuesday evening at the exhibition.

The Okonite company made a very handsome exhibit of samples of its well-known cable and Manson tape, and Mr. Manson distributed among the friends of Okonite a valuable souvenir in the shape of a handsome fountain pen of unique design.

The International Correspondence Schools of Scranton, Pa., saw an opportunity in the exhibition at the Municipal convention and had on hand a representative in the person of Richard de Mutelle and a large quantity of literature descriptive of their various courses. The International Schools are now offering a premium of electrical apparatus worth $10.45, that is given without charge to all who enroll before October 1st in their electrical engineering, telephony or telegraph courses. This offer is worth careful investigation on the part of electrical students looking forward to a course of studies during the coming winter.

President Charles A. Rolfe of the Rolfe Electric company, Chicago, came all the way from Chicago to present to the convention and the East generally his Rolfe telephone and other electrical circuit protectors. Mr. Rolfe is now exploiting a device that has already won its way into the favor of engineers in a manner that has astonished many who know how short a time the Rolfe protector has been on the market. The Rolfe protector opens the line and instrument circuit, also opens the lightning-arrester circuit, which leaves no route for the dangerous current to travel after the operation of the protector. It is worth careful investigation, as written descriptions are entirely inadequate to properly convey the various "fine points" covered by the Rolfe instrument.

The Standard Underground Cable company was represented by Mr. G. L. Wiley, eastern manager. Its exhibit included a very complete assortment of samples of wire and cable used for telegraphic and fire-alarm purposes. The exhibit was contained in a black-walnut case, the samples being mounted on a birdseye-maple board. The samples consisted of a large assortment of rubber-covered, annunciator, office, weatherproof, single and duplex wires neatly arranged in coils, and of telegraph and fire-alarm cables of all the standard varieties. A much admired sample was that of the torpedo-cable type furnished last year for connection to submarine mines and torpedoes and placed in the harbors of New York, Philadelphia and other cities for the government. A high-class lightning arrester, such as was designed for the Baltimore Electrical Subway Commission, for the protection of its fire-alarm circuits, properly connected to a fire-alarm terminal, was also exhibited and met general approval.

Superintendent of Agencies H. J. Doyle and F. T. Hubbell, who looked after the interests of the Monarch Fire Appliance company, originator and sole owner of Kilfyre, did their company proud. Kilfyre is a dry-powder compound, invaluable through its efficiency as a chemical fire extinguisher. The strong claim made is that it will put out incipient fires without any damage other than that already accomplished by the flames. The simple throwing of Kilfyre will concentrate upon the fire many more times the quantity of fire-destroying gases than can be applied in any other way, thus instantly extinguishing the most furious flames of burning tar, naphtha, gasoline, coal oil, turpentine, rubber cement, alcohol and other highly inflammable materials. Although recently launched upon the market, Kilfyre has been indorsed by the insurance fraternity. Many of the great commercial corporations, the company states, notably the Standard Oil company, have entirely ceased the carrying of insurance, fighting their own fires with extinguishers and assuming their own losses, which annually amount to much less than the premiums they would otherwise have paid. Both Postal and Western Union Telegraph companies have adopted Kilfyre for use at their switchboards.

For a long time the Montauk Multiphase Cable company has been promising a most complete and interesting exhibit at the Municipal convention, and Vice-president and Manager C. W. Price, assisted by Elwood Price and H. C. Estabrook, kept their word in a most creditable manner. The various applications of "the only fire-detective cable in the world" were illustrated by most beautiful (mechanically speaking) models as well as skillful personal explanation. The installation and specification hand-book issued by the Montauk Multiphase Cable company, after careful and painstaking preparation on the part of Manager Price, is a volume of which the author can well be proud. This book is invaluable to contractors and installing electricians, as it shows how to locate the cable, gives data necessary for estimates, also a form of proposal, illustrates the method of making joints, branch-block, wall-cases, location of batteries, and, in fact, all the necessary data required by the contractor. The revolutionary principle contained in the construction of the cable consists in the making of every infinitesimal part of a wire in its installation an infallible detecting point for the discovery of dangerous heat or flame, combined with the ability to give automatic notification of the same at any or all points which may be deemed necessary, thus making this cable continuously thermostatic throughout its entire length. Combined in this cable with this great protection from loss by fire are all of the necessary wires for giving every kind of electric service which is needed for all interior electrical installations.

French Electric Fire Engine.

The substitution of electric power for horses for the propelling of fire apparatus has been considered by the fire authorities of Paris for several years. The advantage of the electric automobile vehicle is the gain in speed and the consequent saving of time in case of alarm.

The automobile fire engine illustrated herewith is the first application of electricity for this purpose, says l'Industrie Electrique. The engine was constructed in the department shops. Should experience prove favorable, the department will be equipped throughout with electrical apparatus.

The gross weight of the machine is 2,500 kilogrammes (about 2¾ tons) when mounted ready for a call, and it can run for from four to five hours at a speed of 15 to 22 kilometers (nine to 14 miles) an hour. It carries the men and necessary material for salvage by ladders, as well as for attacking the fire with two streams.

The enclosed motor is mounted on an arch of steel. The forward bearing rests on a sectional axle with a triple-suspension spring support. The rear bearing rests on an ordinary axle, through a simple suspended spring. The motor acts direct upon an adjustable piston.

The hose cart, an independent apparatus, is mounted on two wheels, with a draught tongue. Each of the extremities of the reel-carriage axles is so mounted as to be capable of raising or lowering the reel by means of a lever. The reel carries 160 meters of hose of 70 millimeters diameter. In

FRENCH ELECTRIC FIRE ENGINE.

a box are three nozzles and 80 meters of hose 40 millimeters in diameter. There is also a complete outfit for fighting fires in cellars and similar places, consisting of mask and water shield for purifying the air.

The electrical aparatus, which is in front of the driver of the engine, consists of one voltmeter of 120 volts capacity, one ammeter of 100 amperes capacity, one cut-out block with fusible strips, one distribution center with switches for charging or discharging, a set of switches for the lamps on the vehicle and a lamp in front of the switchboard, and a switch controlling the current of two 10-ampere arc lamps, which may be needed to light up a dangerous darkness.

The motor is rated at about six horse power and weighs 180 kilogrammes. The engine carries a battery of accumulators, weighing 520 kilogrammes, with a capacity of 150 ampere-hours, at a discharge rate of 35 amperes.

It is interesting to note that the weight of the accumulators is only about one-fifth the total weight of the machine, which is remarkably light.

The following table shows the high efficiency of the battery. Specific capacity in ampere-hours per kilogramme of plate is shown in the first column. The second column gives the approximate discharge in hours, and the third the specific consumption in amperes per kilogramme of plate:

	h. m.	
26.7	17.48	1.5
23.8	12.24	2
22.2	7.24	3
20.65	5.9	4
19.35	3.52	5

The specific consumption under motion is never less than five to six amperes per kilogramme of plate, and may attain 10 to 12 amperes.

This engine has been in service since April 26th last, and tested daily. Up to the publication of the article, August 10th, no weak points had been developed in its working.

Scott-Janney Electric Company's Plans.

In a recent issue of the Western Electrician it was noted that the Scott-Janney company had been incorporated at Trenton, N. J., with a capital of $30,000,000, and the company was said to have been organized to compete with the General Electric company and the Westinghouse Electric and Manufacturing company. And it was further stated that a large plant would be built in Philadelphia at once.

A representative of the Western Electrician has interviewed Gordon J. Scott, under whose patents the Scott-Janney Electric company will operate, and also Dr. William S. Janney of the company, relative to the immediate plans of the organization. Mr. Scott and Dr. Janney, speaking for the company, stated that negotiations were now under way for the acquisition of 100 acres of land upon which to erect the company's shops in the vicinity of Philadelphia. It is the purpose of the company to form about 20 sub-companies throughout the United States, each of $10,000,000 capital, to manufacture under Gordon J. Scott's patents, covering a special method of single-phase heat, light and power transmission, and, in fact, electric power work of every description.

The Scott-Janney Electric company is prepared to construct single-phase railways up to 100 miles in length, and also direct-current railways up to 100 miles. And where the Scott gaso-electric system would be employed the company would undertake to operate roads of an indefinite length.

Answering a question as to the nature of the Scott gaso-electric system, Mr. Scott stated that under this system no conductors at all are needed, but that its details can only be appreciated by personal investigation of the method employed. He stated, however, that by means of the Scott electric controller, operating under the gaso-electric system, the speed of cars may be varied at will. The Scott controller, the company claims, as a brake for steam roads is far superior to the air brake, as a train running 60 miles an hour can be brought to a stop within its own length without the usual jarring of the train. By re-equipping an ordinary electric car with the Scott controller, the Scott-Janney Electric company makes the strong claim that with any given road's present motor equipment double the number of cars can be run, this having been tested, the company states, on one of the largest city railroads in the United States. The factory is to be built by January 1st.

Propagation of Cathode Rays.

Prominent investigators differ radically as to the propagation of cathode rays. Some hold, says A. Wehnelt in Wiedemann's Annalen, that the rays from a concave cathode intersect at the focus and form an inverted shadow of an interposed object. Others maintain that they only bend in slightly at the focus and accordingly form an upright shadow. Herr Wehnelt shows that both views are right to a certain extent. He finds that the rays do intersect and form an inverted shadow, but that there exist still other rays which run nearly parallel to the axis of the tube independent of the position of the cathode. This explains the upright shadow seen by so many.

The San Diego, Pacific Beach and La Jolla railroad will soon be operated by electricity.

Wireless Telegraphy in Naval Operations.

At the trials of Mr. Marconi's wireless-telegraph apparatus at the recent British naval maneuvers, the maximum distance to which service messages were sent, says the London Electrician, was 60 sea miles, and this was obtained with apparatus similar to that which has been in use for some time past at South Foreland, the vertical wires being 150 feet and 128 feet long. Mr. Marconi points out that it would geometrically be necessary to have poles 700 feet high at each end, in order that a line between their summits should clear the curved surface of the earth. The greatest height employed above the level of the sea, however, did not exceed 170 feet, so that the Hertz waves, if it was really Hertz waves that passed, had either to go over a dome of water 530 feet higher than the top of the masts, or to pass through it. This thickness of water, Mr. Marconi considers, would probably be much more opaque than Dover cliff. Non-official messages were obtained up to 74 sea miles in one stretch, which Mr. Marconi considers to be an undoubted record for electric waves.

The following detailed particulars of the trials are given in an article by Commander E. P. Statham, R. N., in the Navy and Army Illustrated: When the reserve fleet first assembled at Torbay, the Juno was sent out day by day to communicate at various distances with the flagship; and the range was speedily increased to over 30 miles, ultimately reaching something like 50 miles. At Milford Haven the Europa was fitted out, the first step being the securing to the main topmast head of a hastily prepared spar, carrying a small gaff or sprit, to which was attached the receiver, the wire from it being brought down to the starboard side of the quarter-deck through an insulator, and into a roomy deckhouse on the lower after-bridge, which contained the various instruments.

When hostilities commenced the Europa was the leading ship of a squadron of seven cruisers dispatched to look for the convoy at the rendezvous. The Juno was detached to act as a link when necessary, and to scout for the enemy, and the flagship, of course, remained with the slower battle squadron. The Europa was in direct communication with the flagship long after leaving Milford Haven, the gap between reaching 30 or 40 miles before she lost touch, steaming ahead at a fast speed.

Reaching the convoy at four o'clock one afternoon, and leaving it and the other cruisers in charge of the senior cantain, the Europa hastened back toward another rendezvous, where the admiral had intended remaining until he should hear whether the enemy had found and captured the convoy. But scarcely had she got well ahead of the slow ships when the Juno called her up, and announced the admiral coming on to meet the convoy. The Juno was at this time fully 60 miles distant from the Europa.

"Now imagine," says Commander Statham, "a chain of vessels 60 miles apart: only five would be necessary to communicate some vital piece of intelligence from a distance of 300 miles, receive in return their instructions, and act immediately, all in the course of half an hour or less. This is possible already. Doubtless a vast deal more will be done in a year or two, or less; and meanwhile the authorities should be making all necessary arrangements for the universal application of wireless telegraphy in the navy. The outfit is not expensive; £120 would probably fit up any ship, and it is sure to become cheaper in time."

Two-cent Fares on the Chicago General Railway.

Two-cent fares are now being offered on the branch lines of the Chicago General Railway company. This company for several years, up to 1897, had sold six tickets for 25 cents, good on any of its lines, but at that time discontinued the rate and had since been charging a full five-cent fare on all of its cars. Mr. Charles L. Bonney, the vice-president of the company, states that under the high fare the road was not making any money and that the present reduction was made as a means of increasing the business of the company.

The main line extends on Twenty-second street from Wabash avenue west to Fortieth avenue, a distance of 5¼ miles. On this route six tickets for 25 cents are now sold and transfers are granted to the branch lines. There are two branches, one leaving Twenty-second street at Throop street, and running south on Throop and Morgan streets, a distance of 2¼ miles to Thirty-ninth street, and the other branching off at Rockwell street and running three miles south on Lawndale street to Thirty-sixth street. In the vicinity of Rockwell and Twenty-sixth streets are located the plants of the National Malleable Castings company, the W. W. Kimball Organ company, the McCormick Harvesting Machine company and other manufacturing establishments, and at the end of the Throop street branch are the Union Stock Yards, so that both lines are well patronized. On these two branch roads 12 tickets are sold for 25 cents, without the privilege of transfer, which is practically a rate of a cent a mile. Since the tickets were first issued, on September 6th, the company has had all the business it could attend to and now contemplates adding more cars and extending its lines.

Volta Centenary Celebration.

At the electrical congress to be held at Como next week (September 18th to 23d) in connection with the Volta exhibition and centenary, papers will be read by the following-named gentlemen, among others: Professor P. Blaserna, "On the Disturbances to Galvanometers Produced by an Electric Tramway" and "On the Secular Variations of Magnetic Inclination in Ancient Times;" Professor Silvanus P. Thompson, "On Magnetic Figures and Their Application to the Theory of Rotatory Field Motors;" Professor G. Grassi, "Experiment on the Transformation of Three-phase into Single-phase Current;" Professor G. Semenza, "On Electrical Transmission at High Potential." There will also be a discussion on electrical terminology. Professor A. Righi will open the conference with an address having for its subject the work of Volta. There will be an excursion to Volta's tomb on September 22d and the work of the congress will be diversified by other excursions, entertainments and receptions. The congress is being organized by the Associazione Elettrotecnica Italiana and the Società Italiana di Fisica, and the leading foreign scientific authorities have been invited to attend.

Liquid Air in Prospectus.

Whatever the shortcomings of the Liquid Air, Power and Automobile company of Boston, it is an ardent believer in printer's ink, and in the matter of selling its stock it does not hide its light under a bushel. When it comes to an explanation of its processes, however, it is not so explicit and business-like. The curious-minded who send for the company's prospectus may be entertained and interested, but the practical, hard-headed mechanic will hardly be convinced. The company's "department of finance" is evidently active and flourishing; but in the department of actual performance in operating machinery there still remains a large interrogation point. Still, it is interesting to know what this widely advertised company has to say for itself; and it is to gratify the natural desire for information on this point, and in no way to indorse the company's plans, as far as they are known, that the Western Electrician quotes briefly from the prospectus of the concern. It is of especial interest to note that electric heating of liquid-air pipes is a part of the published plan, and that a dynamo is to be carried on every automobile.

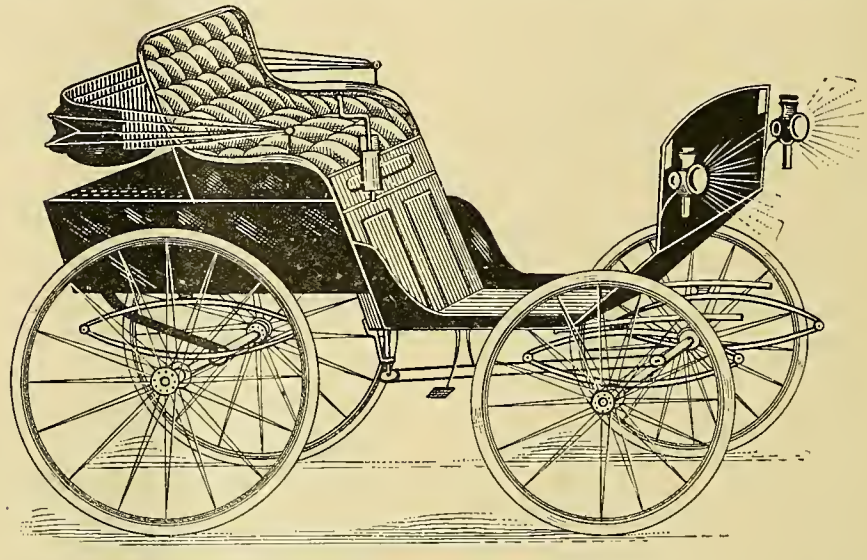


FIG. 1. LIQUID AIR IN PROSPECTUS.—PROPOSED AUTOMOBILE.

A careful reading of the prospectus fails to discover any but the briefest and vaguest references to the manner of producing and transporting the liquid air. The book is mainly devoted to a description of projected liquid-air vehicles, and it is evidently assumed that liquid air can be had in any desired quantity and carried in a tank on the automobile. Liquid air is defined as "simply the atmosphere we breathe, compressed in a series of cylinders, each successive cylinder pressing the air into a smaller and smaller space, the air after each pressure passing through cooling tanks, until, finally, when squeezed into about one eight-hundredth of its original compass, and cooled to 312° below zero, it changes from a gaseous state to a liquid. When this liquid is again exposed to the heat of the ordinary air it expands to its original volume with such rapidity as to exert a force or pressure of over 12,000 pounds to the square inch, giving a tremendous impetus to whatever it encounters; and even this immense pressure we vastly increase by our superheating process." As to the actual production and storage of the liquid air, the following seems to be all the enlightenment that is given: "The machinery for the production of liquid air is being rapidly pushed forward, as also the construction of the tanks for transporting the air, the latter being one of the special devices of Mr. Knudsen. These tanks enable the transportation of air in absolute safety to any distance, and with the very slightest amount of evaporation."

Assuming that liquid air is to be had for commercial use and that in practice it can be carried in a tank on an automobile, the company proceeds to describe its self-propelled wagons. It says that the vehicle illustrated in Fig. 1 weighs less than 300 pounds, "including the motor and a supply of liquid air sufficient to carry it 100 miles, and the cost of the trip is but a few cents."

Next comes the description of the apparatus on the wagon: "From the liquid-air tank (T), Figs. 2 and 3, the air is pumped through pipe (t) by pump (U) and forced through pipe (u) into a small chamber (V). From this chamber it passes into the coils of pipe (V 2), running through the superheating cylinder (V) into the chamber (V 1). These coils of pipe are heated by electricity running through the wires wound around the pipes, the electricity being supplied by the small dynamo (W). From (V1) the superheated air passes through pipe (I) into the rotary motor (X), containing two drums; from the second drum motion is applied by the shaft (x) to the pinion (4), in gear with cog-wheel (5) on shaft (6), to the expansible pulley gear (Z). This pulley gear communicates the motion by belt (B)

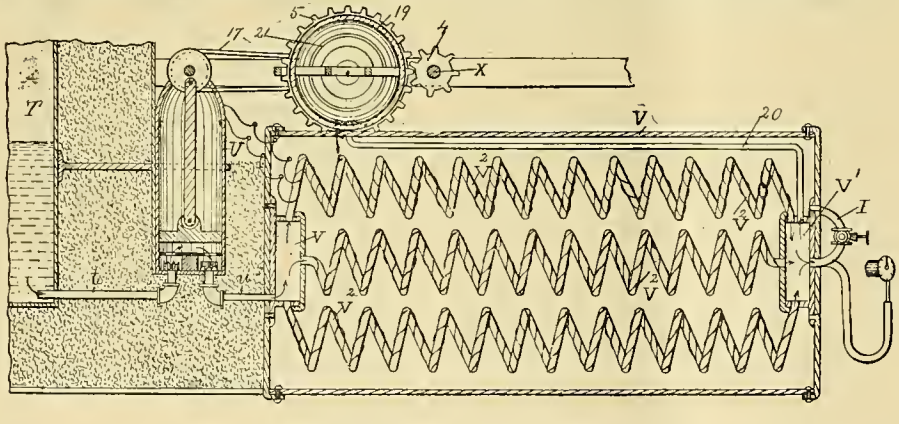


FIG. 2. LIQUID AIR IN PROSPECTUS.—TANK, PUMP AND COILS.

to shaft (7), which is fitted with a beveled wheel (8), transmitting the motion to two beveled pinions on shaft (Q). Through these pinions, the motion is carried by means of a flexible shafting and bevel gears to the rear axle, which operates the rear wheels of the wagon. The carriage is driven, reversed and stopped from the operations of the handle (E) in Fig. 4.

"The supply of liquid air from the pump (U) is very ingeniously regulated by the operation of a spiral spring (21) attached to the piston (22) in the cylinder (19). To the end of the piston rod (22) are attached two arms (23-23), these arms holding belt (17) on the conical pulley (15). Pipe (20) from the superheated air chamber (V 1) communicates with this cylinder (19) in such a manner that when the pump is working too fast the piston is pushed outward, drawing out arms (23-23), and thereby

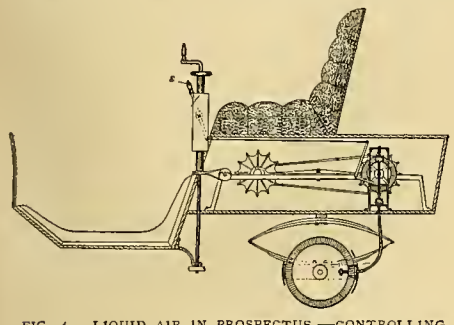


FIG. 4. LIQUID AIR IN PROSPECTUS.—CONTROLLING APPARATUS.

drawing the pulley belt (17) nearer the small end of the conical pulley (15), thus reducing the speed of the pump. When the pump is working too slowly, the spiral speed expands, driving the piston farther into the cylinder, and thus pushing the arms (23-23) toward the large end of the conical pulley (15), which increases the speed of the pump. This makes a perfect automatic safety valve, accurately regulating and controlling the power and the supply of liquid air to the superheating chamber.

"The method of regulating the power is as follows: The expansible pulleys (Z) and (Z 1) connected by belt (B) are expanded and contracted at will, as the bar (A) attached to them is moved back and forth by means of the arm (C), this arm (C) being controlled by the driver. When (Z) and (Z 1) are both of the same size, the medium speed of the wagon is attained; when it is desired to go faster, the pulley (Z) is expanded and pulley (Z 1) contracted, thus giving more rapid revolutions through pulley (Z 1) to shaft (7) and to the driving mechanism of the carriage. At the fullest expansion of pulley (Z) a speed of 12 to 14 miles an hour is attained, or any speed that the carriage may be geared to from the motor to cog-wheel (5). When it is desired to ascend a hill, or in heavy wheeling, pulley (Z) is contracted and (Z 1) is expended, thus giving more power to the driving gear. When pulley (Z) is thus contracted to its smallest dimensions and pulley (Z 1) is expended to its greatest extent the speed is reduced; but a force of two horse power conveys the energy of five horse power to the driving gear."

The last sentence "challenges belief," as the company itself says. Any system of gearing that will transform two horse power at the driving end into five horse power at the driven end is a wonder indeed. Differences of speed are, of course, beside the question, as the most elementary student of mechanics knows.

Fig. 5 is a reproduction, said to be from a photograph, of a "rotary compound engine used in applying liquid-air power," evidently the (X) of Fig. 3.

Central Charging Plant for Automobiles in Chicago.

The Illinois Electric Vehicle Transportation company, of which Samuel Insull is president and Clem B. Rockhill secretary, has purchased the leasehold of the property at 171-175 Michigan avenue, Chicago, for the headquarters of its electric-vehicle business in Chicago. The consideration is said to have been $200,000. The new company will remodel the livery stables now on the premises and use part of the building as a charging plant for its cabs and other vehicles. The current will not be generated on the premises, but will be obtained from the Chicago Edison company. Machinery will be installed for handling the battery trays, so that a set of exhausted cells can be taken from a cab and replaced by a fresh battery in about two minutes. The operation of charging the cells will be going on constantly, so that charged battery sets can be had at any time.

The location is an excellent one for the purpose—downtown and on a boulevard. The plot has a frontage of 105 feet and is 171 feet deep. The offices of the company will be located here, and there will be space for vehicle storage. The property has been long identified with horses and the livery-stable business, and it is significant of the new order of things that it should now become a center for automobile operation.

COMMUNICATION.

Transmitting Pictures by Electricity.

To the Editor of the Western Electrician:

I see by the article on page 147 of your issue of September 9th that the transmission of pictures by electricity has again cropped up.

In all of its essential principles the apparatus described is practically identical with the old Caselli "pantelegraph," described in a book entitled, I think, "Wonders of Electricity," and published by D. Appleton & Co.; the date I do not remember, and I have not the work by me, but I have had it in my possession since 1872, and the device was described as being well known then.

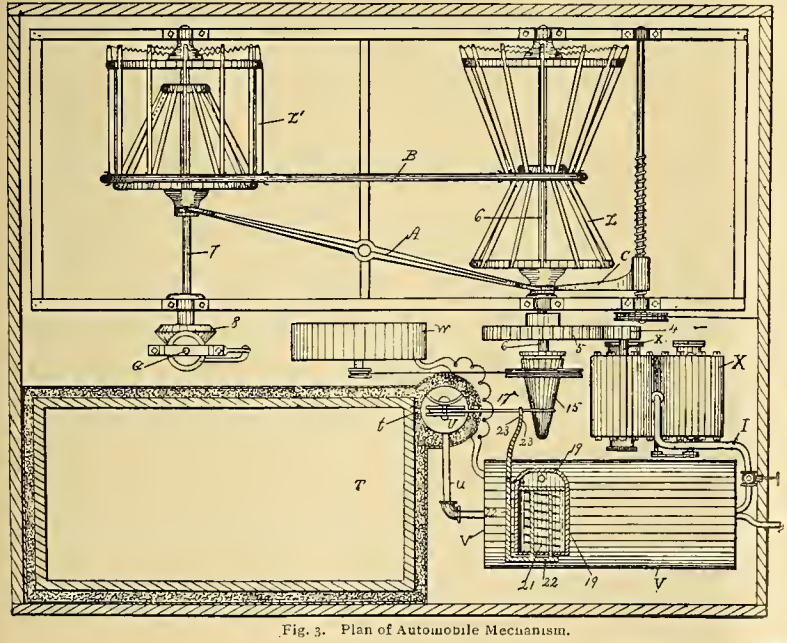


Fig. 3. Plan of Automobile Mechanism.

LIQUID AIR IN PROSPECTUS.

Of course, there was much room for improvement in the old apparatus of Caselli, and I doubt not the experienced electricians, to whom you refer in your article, are capable of extending and improving the principles laid down so as to make the apparatus commercially practicable, which I believe Caselli's device never could have been.

It seems to me that the line for investigation would be some adaptation of the present "process cut" to the system of Caselli; it is not impossible that this has been tried; a simple way of doing it is to mount the flexible needle which completes the circuit to trail over the plate with a stop arranged to prevent the needle reaching the depressions; the plate could be flat and reciprocate by a four-motion feed device, or the needle could be reversed in its trail at the end of the stroke; or the cut could be formed with cylindrical surface in the usual way.

T. J. JOHNSTON.

New York, September 9, 1899.

Possibility of Tax on Patented Articles.

[From the Washington correspondent of the Western Electrician.]

It is understood that the annual report of the commissioner of internal revenue will contain a recommendation to the effect that a tax be levied on the sale and rental of all articles protected by patent. The justice and expediency, to say nothing of the practicability or impracticability, of such a tax is open to doubt.

Patents are granted to promote the progress and prosperity not of individuals, but of the whole people; and it is a well-known fact that the patentee of an invention is in many cases not the person who reaps its financial rewards. That our patent system, which is generally acknowledged to be the best that has been devised in any country, has, on the whole, made for general industrial advancement is a fact generally admitted. It has added much to the wealth of the nation. It has been one of the greatest factors in the development of our natural resources and the building up of our industries. The influence of patented inventions is most strikingly shown in the creation of new industries since 1880, and this is within the term of patents now in force or but very recently expired.

Of these new industries none are more noted than those directly connected with the development and application of electricity, as, for instance, the manufacture of electrical apparatus and supplies, the supplying of electricity for lighting and power purposes, electric railways and the telephone, all of which have had phenomenal growth during the last two decades.

To tax invention might be to kill the goose that lays the golden egg. The intention of the founders and the most intelligent friends of our patent system has always been to lay no tax on invention, but, on the contrary, to expend all the revenues derived from the Patent Office in advancing the interests of invention. That wise intent has already been so far departed from that there are to-day several millions of dollars in the treasury that has been collected from applicants for patents.

In the face of this fact it is well known that Congress has pinched the Patent Office to such an extent that proper examinations have, in many cases, been rendered impossible. One result of this has been the great impairment of the protection afforded by patents.

The nation cannot afford to demoralize the patent system or to diminish in any way the stimulus it affords to the inventive genius of the country by levying a tax on invention. The wiser course would be the expenditure of the fees our inventors have paid and are still paying in the manner contemplated by the laws and commended by sound views of public policy.

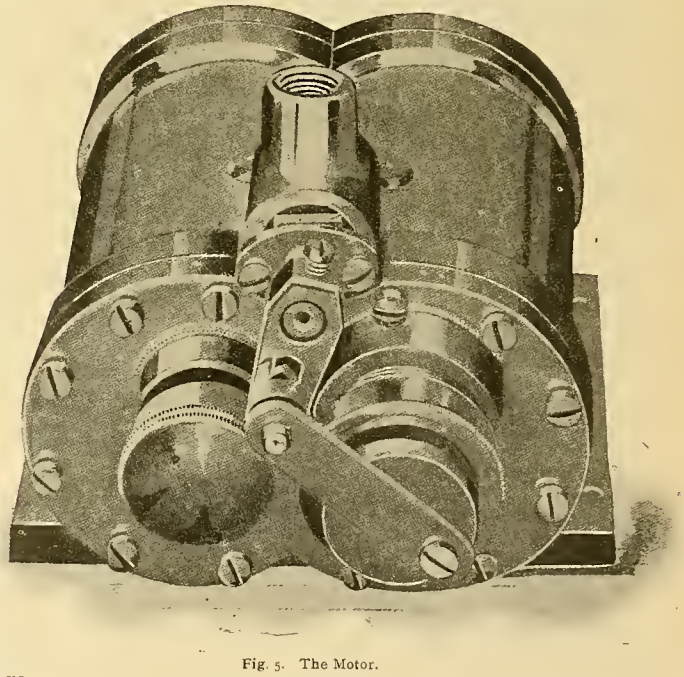


Fig. 5. The Motor.

Fatal Stroke of Lightning on Fair Ground.

A flash of lightning, terrible in its consequences, struck among a group of men on the grounds of the Fair association at Camargo, Ill., on September 7th, while the fair was in progress. Ten persons were thrown to the ground, two being instantly killed. Physicians were at once summoned from Tuscola, and a tent was used as a hospital for the injured. Many women were shocked and stunned. The bolt struck on the north end of the grand stand, which was full of people just a short time before. Nearly all of the killed and injured were young men, and they were seated at supper when the bolt came. The lightning took one man and left his brother, who was seated by his side.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

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CONVENTIONS AND EXPOSITIONS.

International Electrical Exposition in Commemoration of Volta, Como, Italy, May 20th to October 28th. (The date of the festival of the centenary of Volta at Como is fixed for September 18th.)

Philadelphia Exposition of American Manufactures for Export, September 14th to November 30th. (Under the auspices of the Philadelphia Commercial Museum and the Franklin Institute.)

American Electro-therapeutic association, Willard's Hotel, Washington, D. C., September 19th to 21st.

International Exhibition of Moto-vehicles, Berlin, Germany, during September.

Pennsylvania Street Railway association, Stevens House, Lancaster, Pa., October 4th and 5th.

American Street Railway association, Tattersall's, Chicago, October 17th to 20th.

In selecting William Brophy as its president, the National Association of Municipal Electricians has made a worthy choice. Captain Brophy has done much to elevate the standards of electrical construction, and the association does well to do him honor.

It is something of a coincidence that New York and Chicago have each a vague, shadowy plan of utilizing near-by water power for electrical transmission and distribution in the cities. Both schemes are connected, remotely, with the supply of potable water. In New York the subject is discussed in relation to the Ramapo Water company, which thinks that the city should enter into contract with it to reinforce the Croton supply. From the source of this company's proposed supply in the Ramapo mountains to tide-level in New York there is a fall of four or five hundred feet, and it has been suggested that this head of water could be used for power if the scheme of bringing the water to New York is ever carried out. In Chicago the idea is to utilize the fall in the drainage canal, built to drain the Sanitary District of Chicago into the Illinois River, and thus protect the water of Lake Michigan, used in the city waterworks, from the pollution of sewage. But there are almost insuperable objections in both cases, and it is unlikely that either plan will be carried out.

Marconi is said to be on his way to this country to install the apparatus by which the international yacht races are to be reported by space telegraphy for the New York Herald and the Chicago Times-Herald. He will not appear before the British Association, which opens its meeting on the day he is announced to sail for New York. It is said, however, that the British scientists, who are to meet in Dover this year, will devote much attention to the subject with which Marconi's name is so intimately connected. The young Italian inventor will be heartily welcomed in the United States, where his work has been admired and appreciated. Marconi is to space telegraphy what Morse was to ordinary telegraphy or Edison to incandescent electric lighting—not the first, perhaps, to conceive the idea, but the first to evolve a practicable, working system. He is entitled to much credit. A word of praise is also due the enterprising newspapers which propose to use the new means of communication in reporting the races between the Columbia and Shamrock.

That most enterprising nation of the Orient, Japan, has, during the last few years, assumed an important rank in the list of commercial nations, and in doing so has greatly increased her trade with the United States, which was instrumental in first opening the doors of that country to commerce with the world. There are great possibilities for electrical apparatus in Japan. Only one electric road is now in operation in that country—that at Kioto. The use of dynamos, motors and other classes of electrical machinery will certainly increase very rapidly. New electric railways in the leading trade centers are projected. In the matter of dynamo-electric machinery the United States is well ahead in the foreign trade of Japan, and should strive to maintain its lead, as there is no doubt that with the opening up of the Island Kingdom, consequent upon the operation of the new treaties of 1899, the demand for this machinery will be greatly stimulated.

The Japanese have no prejudice against American manufactures; on the contrary, their superiority is freely admitted in many lines.

Under the tariff law of Japan, which went into effect on January 1, 1899, electric-light machinery and parts are dutiable at the rate of 10 per cent. ad valorem; telephonic machinery and parts, 10 per cent.; galvanized telegraph wire, 10 per cent.; tram cars and parts, 10 per cent.; submarine and underground cables, 10 per cent.

Here's the Electrical Review of London in tears, making pages of fair, white paper somber with its lamentations, and all because the Allis company of Milwaukee, Wis., U. S. A., has secured the contract for engines for the new Glasgow street-railway plant. Look at the matter as one will, it cries, Glasgow has blundered. The "tramway committee," it reflects, must have been fully alive to the fact that if it employed an American consulting engineer [Mr. Parshall] he was extremely likely to be partial to America. Again, speaking of the specifications, our embittered contemporary cannot refrain from this remark: "It appears that the Allis company accepted the dimensions of Mr. Parshall in toto; it would be interesting to know how he arrived at them." Is this not a veiled insinuation of possible collusion between one bidder and the engineer? Is not such conduct considered dishonest as well as dishonorable in England? Is it true that all Englishmen, at bottom, have a lurking suspicion that all Americans have to be constantly watched lest they resort to tricky methods, scamped materials and equivocal evasions? We do not believe that this last inquiry could be truthfully answered in the affirmative, but it seems to be but too true that there are millions of Englishmen who have an ingrained distrust of Americans and all things American—perhaps one might go further and say of everything that is not English. The average Englishman may be thorough and painstaking, if you like; but his mental processes are not as quick as those of the average American; and he is apt to be extremely doubtful of an alertness and adaptability which he can but dimly understand and may not appreciate. He sees clearly enough that Americans are boastful, which is true; but he does not discriminate between that self-commendation which is playful, that which is based on an honest pride in national achievement and that due to ignorance or mere gasconade. In short, as a nation, England is over-conservative, inclined to be prejudiced and conceited, and unwilling to admit equality, much less superiority, in the other nations of the earth. With more open mind, the people of the United States, recruited from all the nations of Europe, see clearly the elements of England's weakness as well as the sterling traits of England's greatness. Let us hope, too, that profiting by the example of England's over-confidence, we guard against our own national foibles and faults, that we may earn the true respect of England and all others of the family of nations.

But this is digressing somewhat from the interesting case of the Glasgow corporation. The English Electrical Review contends that it was unnecessary to go to America, as "no American firm has yet produced better steam engines than are turned out in our English shops." It states, also, that many will consider that there is strong evidence of a foregone conclusion, and complains that "a gift of £20,000 is to be made to a foreign firm for an article in no way superior to the home production." The last statement refers to the fact that the offer of the English firm championed by the Review was £20,000 less than that of the Allis company.

The truth of the matter seems to be that the Allis bid was accepted, at a higher figure, because the American company agreed to make delivery within the stipulated time and to build the engines according to specifications. Everyone will admit that these are important considerations in the awarding of a contract; and possibly the well-known experience of the Milwaukee concern in street-railway work had some bearing on the result. The English critics assail the specifications; but it is unlikely that the Glasgow people retained Mr. Parshall without fully considering his character and professional attainments. Having carefully selected their engineer, they wanted the use of his ideas and the class of apparatus he specified. An amusing feature of the controversy is the fact that the English journal quoted devotes a long article, in its issue of September 1st, to a criticism of the specifications, only to find a little later that its premises were all wrong. In the same issue of the paper with its attack on American methods, but on a later page, it is moved to make this correction: "That portion of the article, alluding to what we understood to be the American tender, need not be seriously considered, nor our remarks on Mr. Parshall's apparent requirements, which are now shown to be unwarranted."

The whole objection to the award to the Allis company seems to be unwarranted and based on jealousy. As a Glasgow newspaper remarked, the corporation of that city cannot invite outsiders to bid on its work and then seek for a loophole of escape from its own act.

Telegraphs in Argentina.

By A. F. Tennille.

On September 30, 1875, an act, containing 162 articles, was passed by the Congress of the Argentine Republic for the government of the telegraphic lines operated and owned by the government of that country, amounting to 10,650 miles at the present time, with a wire length of 22,775 miles, and representing a monetary value of $5,811,042. It is curious to note that in Argentina there are four different systems in existence: First, the lines operated and owned by the government; second, lines owned and managed by several of the provinces or states, within their own boundaries or territory; third, those owned and controlled by the railway companies, and fourth, those owned by private corporations. Yet between all these varied interests there exists a general tariff, of which the national line sets the controlling price, and this general schedule has, by agreement, been extended into the republics of Uruguay, Paraguay and Bolivia.

The national government of Argentina was not confronted with an enormous expense for the purchase of immense corporations to establish its lines, for all of the lines owned by that government were built by the nation, and none were purchased of outsiders; and the same state of affairs exists with regard to lines owned by the various provinces.

The provincial, railway and private lines have a combined length of 14,144 miles and a total wire length of 33,087 miles; and the value of these three systems combined has been placed at $9,188,958. To construct these lines, it is estimated that the cost of the national lines has been $508 per mile, while that of the railway and private lines has been $418. These figures include the whole cost in each instance, both for lines, offices, instruments and all other requirements. While this cost is very much cheaper than in the United States, it must be remembered that the services and equipments are in many ways largely inferior to our own.

Under the question of tariff, I think one very desirable feature that might well be emulated in the United States is that it is universally the same, regardless of distance; there is, however, a limit to the number of words which a message may contain—100 words—but it is a peculiar rate of 30 cents for each message and three cents additional for each word contained therein. Press rates, however, are only 50 per cent. of that tariff. In Buenos Ayres the daily press telegrams amount to about 50,000 words. During the year of 1896 the revenue from the government lines amounted to about $1,157,052, and those from the other lines to $1,106,698.

Under the law previously mentioned it is provided that all electrical equipment needed by the telegraph lines of the republic may be imported free of duty for 10 years after their establishment.

In every instance, where practicable, the national telegraph office is established in the postoffice. The administration of the telegraph and postal communication in Argentina is relegated to a director-general, under whom is a secretary, and it is again subdivided into three sections. The first of these sections has under its charge the monetary and legal affairs; the second, the internal and external mail and express service, and the third comprises the immediate direction of the service of the telegraph lines belonging to the government and the exercise of superintendence over the general direction on private lines established in the republic.

The director-general is the principal head of the administration, and he has the right to project new lines, open up new offices, arrange the tariffs, to contract for all new lines, instruments and materials and decides upon the advantages which may accrue from the establishment of new lines. He also has a privilege of censorship over private messages in so far as they may be detrimental to the safety of the state, contrary to the laws of the country, detrimental to public order, to good customs, or which may be written in insulting terms; but to prevent this authority from becoming too autocratic, the law provides for legal proceedings on the part of the individual should he feel himself aggrieved.

All companies contemplating the erection of new lines are required first to submit to the executive a complete description of the proposed line and stations, the number of telegraph posts to each kilometer, the number of wires to be strung and the dimensions and quality of both these requisites; a general description of the ground and of the nature of the soil, also the description of the sources of electricity, and of the instruments to be employed. A curious feature of the requirements makes it possible to erect a line so that the lowest wire may come within a distance of 11 feet from the ground.

At the present time all the telephone lines in the republic are owned by private companies, and stations are in operation in almost every city of importance, the present number of instruments in use being 24,800; there is no law at present governing these companies, though there is said to be one in course of preparation. The monthly rental is not fixed, but is about $12 legal tender.

A submarine telegraph line has been in operation between Buenos Ayres and Montevideo, Uruguay, since 1866, and there is also cable communication between the former city and the United States.

Electrical Machinery in France.

Although there are quite a number of large works in France engaged in the manufacture of all kinds of electrical machinery and appliances, yet the import trade is by no means insignificant, and it is gratifying to see that the share of the United States has largely increased during recent years.

The latest available detailed statistics on the French foreign electrical trade are those for the year 1897.

In that year the imports into France were as follows:

Dynamo-electric Machines.

	Francs.
From Switzerland	2,107,500
From United States	1,407,500
From Germany	445,000
From Belgium	320,000
From other countries	132,500
Total	4,412,500

or $882,400, to which the United States contributed $281,400 worth, or about 32 per cent.

Accumulators.

	Francs.
From Belgium	21,100
From Germany	7,840
From other countries	9,210
Total	38,150

or $7,630, to which nothing was contributed by the United States.

Parts of Electric Machinery.

	Francs.
From United States	662,220
From Switzerland	589,100
From Germany	365,500
From Great Britain	90,300
From Belgium	77,400
From other countries	116,100
Total	1,899,620

or $379,920, to which the United States contributed $132,400 worth, or about 35 per cent. Taking the three tables together—

Dynamo-electric machinery	$ 882,400
Accumulators	7,630
Parts of electric machinery	379,920
We get a grand total of	$1,269,950

of which the United States' share was $413,800, or about 33 per cent. of the total French importation.

The most striking feature of this trade is the great share secured by Switzerland. Electric industries in this little country are assuming larger proportions year by year. In spite of the fact that Switzerland has to import every pound of iron and every pound of coal used in its industry, yet its engineering works have been brought to an extraordinarily high degee of efficiency. In 1897 the exports of Swiss-made electrical machinery amounted in value to 8,274,000 francs, an increase of 2,796,000 francs over the preceding year. The industrial progress of this little country, whose area is about one-third of that of our state of New York, is marvelous indeed. In 1897 the total exports of "machinery" from Switzerland were valued at $6,800,000.

As to the exports of electric machinery from France, the following may be mentioned:

In 1897 France exported "dynamo-electric machinery" to the value of 2,089,076 francs (about $416,000). Her best buyer was Spain, which country received more than 40 per cent. of the total exports (846,749 francs' worth). A considerable quantity of French dynamos was exported to French Indo-China, amounting in value to 219,420 francs. The total value of all kinds of electric machinery exported in 1897 by France to her colonies and protectorates amounted to 417,068 francs.

Incandescent electric lamps are imported and exported in quite considerable quantities. The imports in 1897 amounted in value to 569,420 francs, chiefly from Germany (319,180 francs) and from Italy (105,640 francs), while the exports of incandescent lamps were valued at 612,620 francs, of which 101,000 francs' worth went to England, 100,000 francs' worth to Brazil, 96,000 francs' worth to Spain. The United States received 41,000 francs' worth.

On the whole, it may be said that the United States is already fairly represented in the French electrical trade. An immense field is open there for American manufacturers, and the most strenuous and energetic efforts should be made to increase our share with the rapidly increasing demand of the French market. G.

Power Transmission on Warships.

In a recent article in the Engineering Magazine G. W. Dickie, a well-known naval designer, says: "In the important matter of power transmission I do not know of a single ship in which one mode of transmission has been adopted throughout the ship. Steam pipes, water pipes and electric wires are still run side by side from end to end of the ship, where one would answer all purposes. While I have been a strong advocate of hydraulic power transmission on warships, there are so many operations in which electric transmission seems to meet the conditions more directly that I now think we are fast reaching a stage of development in the application of this subtle agent which will render it the best means by which to operate all mechanism requiring power on board warships. The use of only one means of transmitting power on a given ship would be a great step in the direction of simplicity."

The Phillips Clambake.

One would naturally be inclined to believe that it would be a difficult matter yearly, throughout the long period of 21 years, to give annually an entertainment of such a character that each year's celebration should outdo that of the preceding year. But the unanimous verdict of those gathered at the Pomham Club in Providence last Saturday to partake of Eugene Phillips' hospitality for the twenty-first time was that the general manager of the American Electrical Work had again broken the record.

The majority of those who had been invited to witness this evidence of Rhode Island's hospitality assembled in the rotunda of the Narragansett Hotel at 10 a. m., Saturday, and were there welcomed by General Manager Eugene Phillips and President Frank Phillips of the American Electrical Works. The gentlemen were at once marshaled into line to register and "receive the badge," which ceremony has become a function of the Phillips entertainment. Street cars were then taken to the Pomham Club, about six miles from Providence, where the "bakes" of this year and also of '98 were given.

Arriving at the grounds about 11 o'clock, the party was soon joined by the Boston contingent, and when all had registered and the count been made it was discovered that this year the record had surpassed that of any preceding year, as the highest number of any badge showed the figure 366. It is only necessary to note the fact that last year there were 306 guests present as against 285 the year before, fully to realize the extraordinary appreciation of Mr. Phillips' novel method of entertaining the host of friends of his prosperous institution.

Just before dinner the guests were called in from the baseball field, rifle range, bowling alley and other amusements to sit for the clambake picture that has always formed another function of the gathering. Immediately after the photograph had been taken the 366 guests sat down at the banquet tables. After partaking of the bounteous spread, that literally consisted of every delicacy of the season, Mr. Phillips appointed a toastmaster, and speeches and story-telling were indulged in until train time for Boston and New York, when the guests gradually dispersed, one and all praising the twenty-first annual Phillips clambake as the "greatest yet."

Yacht Races to Be Reported by Wireless Telegraphy.

[Special dispatch to the Western Electrician.]

New York, September 12.—The Herald announces that it has made arrangements with the Wireless Telegraph company of London for the exclusive use of the Marconi system of wireless telegraphy in reporting the America Cup races off Sandy Hook. By means of the Marconi system and submarine cable and land wires, messages will be transmitted to the Herald office and bulletined almost simultaneously with the movements of yachts described in dispatches.

Signor Marconi and four trained assistants will sail from Liverpool to-day on Cunard steamer Aurania, with instruments. Work will be under the personal supervision of Marconi himself. The assistants are the same who have been engaged in transmitting wireless dispatches across the British Channel during the last six months.

The transmitting instrument will be upon the large ocean-going Plant line steamer Grande Duchesse. Upon the upper deck of the vessel will be placed a tall pole, 60 feet in air above the water line. Signor Marconi and two assistants will be on this vessel, and a running account will be telegraphed by them.

On the cable ship, anchored near Scotland Light, a similar pole will be erected, and here two expert operators will be stationed to receive messages from the swift-moving Grande Duchesse. From the cable ship the messages will go by submarine and land wires direct to the Herald office. F. L. P.

Treatment of Electric Shock.

A New York dispatch states that the assertion is made by Dr. Richard H. Cunningham of Columbia University that he can restore to life a person who seemingly has been electrocuted. Dr. Cunningham has for a long time been engaged in making experiments at the Vanderbilt clinic, in New York, on dogs, turtles and frogs. He states that it has been demonstrated beyond contradiction that an animal apparently killed by contact with an electric current and in whose body respiration and circulation have ceased may be brought to life.

Experiments which the doctor has made seem to establish the fact that in cases where death occurs from an electric shock it is not caused by paralysis of the heart or by any of the causes to which death has heretofore been attributed, but by fibrillar contraction of the heart, which results in collapse of the nervous system. To restore quickly the circulation, Dr. Cunningham creates artificially a temporary circulation of a fluid capable of sustaining the heart and the nervous system until the heart has recovered sufficiently to maintain the circulation in the normal manner.

DEVELOPMENT OF THE TELEPHONE FIELD.

Privacy of Telephone Communications.

By H. P. Clausen.

Part II.

Not many miles from the city of Chicago there is in active operation a telephone circuit which, during the spring of 1898, created a great deal of ill-feeling among its several owners by giving publicity to a number of messages passing over it. The line under consideration was 30 miles long and equipped with three instruments, as shown by Fig. 4. The (B) station was located near the center of the line and placed in a railway-ticket office. The (A) and (C) stations were placed in private offices of the villages, which, for the purpose of our account, we will call Antwerp and Benton.

A few months after the system was installed and had been found to give excellent service, the Benton subscriber made the annoying discovery that a confidential message sent for transmission by telegraph to the (B) station, had been communicated to a rival in his business, residing in the town of Antwerp. Believing that the message might have leaked out by accident, through no fault of the operator at (B), no further attention was paid to the subject at that time. However, in the course of another week the same thing happened, and the matter was then taken up with the (B) operator in order to locate the source of the leakages.

In the course of his investigations the Benton subscriber learned that his rival in Antwerp could not well have been informed of the messages through treachery on the part of the (B) operator, as the latter was not on friendly terms with the former. This conclusion left two other channels open for an investigation. The most probable theory was that the (A) operator at Antwerp was the eavesdropper and afterward the telltale. This was (B's) contention, while (C) maintained that the telegraph operator at a small station 12 miles south copied the messages and repeated them to (C's) rival at Antwerp. This telegraph station is shown at (D), Fig. 5. This presumption was strengthened by the fact that the (D) station was connected to the rival's office by a private telephone circuit.

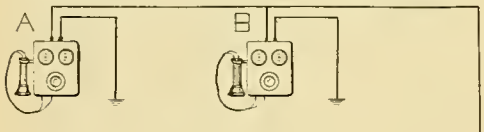


FIG. 4.

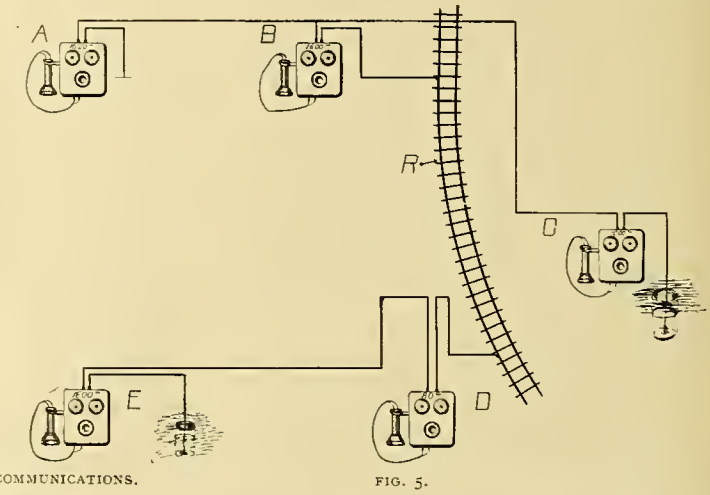


FIG. 5.

PRIVACY OF TELEPHONE COMMUNICATIONS.

In order to determine the question definitely a number of decoy messages were sent from (C) to (B), who received them telephonically, but did not send them by telegraph. Thus, it was hoped that the (D) operator's complicity might be fixed. The experiment succeeded. The messages were found to have been communicated to outsiders.

There remained now only one more test to be made, and that was to cut off the (A) branch of the circuit while (C) sent a message to (B). This was done in the following manner: After signaling (B), which also operated (A's) bell, the (C) subscriber would communicate the decoy message to (B), but not before the latter opened the (A) branch. This test, it was confidently anticipated, would show that the real culprit was to be found on the (A) branch; but, on the contrary, the leakages continued as before.

As may be imagined, these decoy-message tests required a lot of time and careful observations, and, after all, they led to nothing. It was only by chance that the mystery was cleared. In the late fall of 1898 the (B) operator happened to stop off at the (D) station. While there he observed the telephone equipment, which he learned was the one connected with an instrument located in the office of (C's) rival at Antwerp. Idly placing the telephone receiver to his ear, he was attracted by what appeared to be a faint cross-talk from parallel wires. The sounds were not loud enough to permit them to be understood, but all of a sudden the sounds came up clear and strong, and what startled the listener most was the discovery that he was listening to a conversation being held between the (C) subscriber and the relief operator at (B).

This discovery explained the whole mystery. (C's) rival at (E) had a direct electrical connection with the line (B) (C): but how this connection was made remained to be discovered.

Calling to his aid an acquaintance who had an assortment of measuring instruments and who knew how to use them, a series of tests was made and the ground thoroughly gone over, with the result that to-day there is no cross-talk between the (D) (E) and (A) (B) (C) stations.

The findings were as follows: The (A) station instrument bell magnets measured about 1,600 ohms. While measuring from the line wire to the ground rod, through the (B) and (C) instruments in parallel, a resistance of 7,000 ohms was secured, this indicating a very poor ground connection. The (B) station bell magnets measured 1,600 ohms, but from the ground wire (which was connected to one of the steam-railway rails, as shown) to the line wire the resistance was less than 1,800 ohms. Measurements made at the (C) station gave about the same results. Access to the (E) station could not be secured, but the observation was made that the (E) telephone ground wire was connected to the iron pipes of an artesian well. (The (C) station made use of the same kind of "earth.") At the (D) station the bell magnets were found to measure about 80 ohms, while the ground wire was connected to the same rail as that of the (B) station equipment. Now, by measuring back toward the (E) instrument, the circuit was found to measure about 2,000 ohms.

Fig 5 clearly shows the conditions as they were found by (B) and his assistant. The diagram also explains why a message passing between (B) and (C) could not be understood by an eavesdropper at (D) unless the (E) station high-retardation bell magnets were cut out of circuit, which would be the case with a person listening at the (E) telephone. On the other hand, the (D) telephone bell magnets, being of comparatively low resistance, offered no great bar to the voice currents, and it was therefore possible for the (E) operator to hear any message passing between the (C) and (B) stations by way of the rail (R), which was not "dead grounded" at any time, the roadbed being of a dry, sandy character.

In conclusion, it may be mentioned that the trouble was "cleared" by connecting the (B) station ground wire to a good earth and dropping the rail connection altogether.

An Alleged $3,000 Conversation.

[From the New York Sun, September 4th.]

A person in Brooklyn and a person in St. Louis talked to each other for about 50 hours last week over the long-distance telephone and it cost them more than $3,000 for the privilege. Neither party to the conversation was a woman and there is nothing on record to show whether St. Louis or Brooklyn had the last word.

Most of this talking was done between the hours of 8 p. m. and 6 a. m., when the rate between Brooklyn and St. Louis is $5 for the first five minutes and a dollar a minute for additional time. The day rate is $10 for the first five minutes and $2 a minute for additional time. At least one of the talks, however, lapped over into the high-priced hours, for the bill for it was $716. To talk steadily from eight o'clock in the evening until six o'clock in the morning at the rate of a dollar a minute would cost only $600.

The man in Brooklyn and his friend in St. Louis were both telephone subscribers and carried on their conversation through their own receivers in their homes or offices. Every precaution was taken in the office of the telephone company to protect the talkers from interruption. No one was allowed to break in on the wire, and at each end of the line where the plug was inserted in the switchboard a card was hung up warning operators to keep off. The chief operator at the office of the Long-distance Telephone company in this city admitted yesterday that the $3,000 conversation had taken place, but said that he could not tell anything about it, as that would be contrary to the rules of the company and to the laws of the state.

SUBSCRIBERS AND RATES.

The Illinois Telephone and Telegraph company claims to have secured 5,000 conditional contracts for telephone subscribers in Chicago.

The Shenandoah (Pa.) Herald says that the rival telephone companies in Lebanon are making things easy for the users of that service. The old company is now putting telephones in residences for $15 a year and in business places for $18.

"Nearly every one of the New England Telephone company's subscribers in this city," says the St. Albans (Vt.) Messenger, "is complaining loudly against the enormous increase in rates which went into effect September 1st. A well-known business man said that the company was much surprised at the very large number of telephones which have been ordered taken out since the notification of the increase was made. He further said that the business men intended taking steps toward forming an organization to fight the monopoly."

Affairs in Noblesville, Ind., are arranging for a big telephone war, according to a correspondent of the Indianapolis Sentinel. "The New Long-distance company that has just completed a line between this city and Indianapolis has arranged for connection with a local exchange owned by local capitalists, and will charge $12 per year for telephones in private residences and $15 per year for business houses. The Central Union company's prices are $15 for private residences and $20 for business houses. It is understood that when the new plant is in operation the Central Union will cut below the opposition company in prices. If it comes to this the directors of the new company say they will also come down As it is impossible for both companies to do a paying business here, the fight will resolve itself into the question of who can hold out the longest. Business men are expecting the yearly rate to be as low as $1 before the fight is over."

COMMUNICATION.

National Telephone Company of England.

To the Editor of the Western Electrician:

Reading the very interesting article on page 137 of your issue of September 2d, regarding the National Telephone company, Limited, of England, we are led to add to the information already given. The National Telephone company, Limited, is the only telephone company in Great Britain owned and controlled by private capital. It is the only company licensed by the government and doing business under license from the postmaster-general. The competition referred to is solely that of the government postal telegraph and telephone lines, which were first authorized by act of Parliament in 1892.

Further, we may state that the National Telephone company, Limited, of England has the exclusive agency for Great Britain for the telephones made by L. M. Ericsson & Co. of Stockholm, Sweden; and as an illustration of its requirements, we are informed that one order placed with Ericsson & Co. was for 10,000 of the Swedish desk sets, our No. 375. ERICSSON TELEPHONE CO.

New York, September 5, 1899.

EXTENSIONS AND IMPROVEMENTS.

The Southern Bell Telephone company will install an entire new plant at Pensacola, Fla.

J. E. Brewer has made arrangements to construct a telephone line between Wichita Falls, Tex., and Hot Springs.

Th new Bell line from Troutburg to Albion, N. Y., is now completed. The line is about 18 miles in length.

The Union Telephone and Telegraph company of Baltimore has been granted by the City Council of Franklin, Pa., a franchise for the construction of a telephone system in that city.

The Home Telephone company, within a few weeks, will fill the gap between Moville and Holstein, Iowa, building through Pierson, which will give Sioux City direct connection with that town.

The Chester County (Pa.) Telephone company is rapidly getting into shape for the final extension of its lines, and within a couple of months will be doing business in several places in addition to West Chester.

At a recent meeting of the Binghamton Telephone company the contract for the construction of the new system was let to the Eastern Electrical Construction company of Philadelphia. Work upon the construction of the system will be begun as soon as the necessary list of subscribers is completed.

Manager Parry at Hamilton, O., states that nearly 600 telephones have been connected. He also says that this company intends to build branch lines to Winchester by way of Lynn and Fountain City, to Camden by way of Eaton, to College Corner by way of Liberty and to Greenville. Other work is also in contemplation.

The Home Telephone company of Crawfordsville, Ind., will soon have an entire new exchange equipment, having just placed an order with the Sterling Electric company of Chicago for a 1,000-capacity switchboard, with 600 numbers mounted, also cross-connecting and distributing board and 600 combined office terminals and protectors.

The Bishop Telephone company of Central City, Iowa, has lately extended its lines to Palo, Shellsburg, Brandon and Rowley, making about 50 miles of new line. The company also intends to extend from Dundee to Lamont and Aurora. It has $25,000 capital, 400 miles of wire and excellent connections. As soon as the new Independent exchange in Dubuque is opened, the Bishop company will make a connection with it.

The Bangor (Me.) Commercial says that the Eastern Telephone company, which is creeping over Maine with its $12 a year rate, has lately issued new cards for its 600 or more subscribers. There are now thriving exchanges in Rockland, Thomaston, Vinalhaven, Warren and Waldoboro, and pay stations at Clark's Island, Camden, Friendship, Long Cove, Martin's Point, Martinsville, North Haven, Owl's Head, Port Clyde, Pleasant Beach and other places.

The National Telephone company of Fort Wayne, an Independent corporation, which has a line in operation from Fort Wayne to Auburn, Ind., has the material on the ground to extend its line from Auburn to Butler, where this line will be connected with those of the Butler Telephone company. The United States Telephone company, an Independent company that has lines all over Ohio and Southern Michigan, has poles set and is putting up the wires to connect with the Butler Telephone company's lines from the east. This will give the Butler Telephone company connection with all important points in Ohio as far east as Cleveland; also in Southern Michigan and to Fort Wayne and nearby towns. All business will go through the Butler office, which will make Butler a sort of center of distribution.

REPORTS AND ELECTIONS.

The Muncie (Ind.) Telephone company has been reorganized. The plant was lately bought by D. F. Allen of Frankfort, who was elected president. J. M. Palmer was re-elected secretary and manager, and Judge O. J. Lotz, Thomas McKillup and J. A. Hedgecock of Frankfort are the directors.

The Jefferson-Warren Telephone company of Warren, O., has elected directors as follows: E. J. Clapp of Warren, Fred Harrington of Jefferson, C. W. Devoe of Orwell, E. E. Howes of Mesopotamia and Dr. C. S. Fenton of Orangeville. The directors elected Mr. Clapp president and secretary and Mr. Devoe treasurer.

At the recent annual meeting of the Citizens' Standard Telephone company in Kingston, N. Y., the following-named directors were chosen: John H. Farrell, John M. Bailey, Ten Eyck F. Mosher, James H. Leake, Stephen V. Frederick, Cornelius Hill, all of Albany, and Jay E. Klock of Kingston. Officers were elected as follows: President, John H. Farrell; vice-president, Jay E. Klock; treasurer, James H. Leake; secretary, Ten Eyck F. Mosher.

Illinois Telephone Company Discusses Conduits.

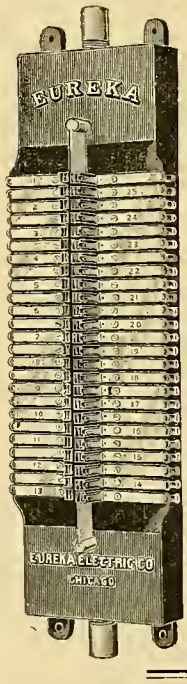
President Albert G. Wheeler of the Illinois Telephone and Telegraph company, organized to compete with the Chicago Telephone company, has made a formal application to the commissioner of public works in Chicago for permission to open the streets to lay its conduits. The application recited that the first highways the company desires to use are Clark street from the river to Twelfth, Monroe street from Clinton to Michigan avenue, and Franklin street from Michigan to Van Buren. An accompanying blue-print showed a proposed conduit four feet wide and seven feet high.

Mr. McGann, the commissioner of public works, wanted more information. He asked these questions of Mr. Wheeler: "Will you please inform me what is the necessity for a conduit of the size shown on plan submitted? What will be the depth of the conduit below the surface? Cannot manholes be placed so as not to come in the intersections of streets where, when in use, they obstruct traffic more than in the middle of blocks? What is to be your method of construction—by excavation or tunneling? If by tunneling, what method of construction or shield are you going to use? Do you propose to use the pneumatic system? Have you made investigation along the route proposed to ascertain what obstructions may be in the way of constructing this conduit?"

In answer Mr. Wheeler said:

1. We intend to place 30,000 telephones in Chicago at one-half the price of the old company, and a conduit four feet by seven feet is little enough to carry all the wires we need. The conduit is not to be used for any other purpose.
2. Twenty-five feet will be the depth below the surface, because this will enable us to steer clear of all other obstructions and will be low enough not to interfere with any scheme of a municipal subway.
3. We never intended to place manholes at intersections of streets. We will cut through the ground only once in every 1,000 feet.
4. Tunneling will be the method of construction.
5 and 6. The airlock system will be used.
7. There are no obstructions along the route at the depth proposed.

The commissioner said he would consult the mayor before issuing a permit. What he wanted to guard against was possible danger to the foundations of buildings and an interruption of street travel during the time of the fall festival.



Eureka Cable-head Protector.

The Eureka Electric company of Chicago is now placing on the market a new and improved combination cable-head protector. The company claims for this device that it will be a protection to telephone-exchange switchboards from sneak and strong currents. It is so constructed that a heat coil can be used or, if desired, a fuse coil. The company is also at the present time at work upon a new type, bridged, extra-strength, toll-line, cabinet telephone, which it will build in two strengths, one for ringing 25 telephones upon a bridged toll line, and the other to ring loudly and clearly any number of telephones up to 50 instruments upon one bridged line. This is said to be an instrument of novel design, and a description of it will soon be issued. The Eureka company will be pleased to give particulars of its line of high-grade apparatus upon application. Its new fall bulletin is now being sent to all telephone companies.

Sterling Electric Company to Remove its Factory to Lafayette, Ind.

The Sterling Electric company of Chicago is about to remove its factory to Lafayette, Ind., and with the addition of the new plant the company will employ, it is said, over 500 hands and will rank among the largest manufacturers of telephone apparatus in the country. The Sterling company has been very successful, and it attributes its growth to the high character of its appliances. It began business in February, 1898, operating under patents granted to Frank B. Cook, for 17 years chief engineer of the Central Union Telephone company. Mr. Walter E. Doolittle is associated with Mr. Cook. The business has grown so rapidly that, after twice enlarging its quarters, the company feels the need of facilities twice as great as those it now possesses. This expansion certainly speaks well for the management of the company as well as the character of the apparatus.

The American Telephone and Telegraph company has been incorporated in Mississippi, with a capital stock for that state of $25,000.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Wisconsin Telephone company will place its wires in the business part of Appleton, Wis., underground.

The Zenith Telephone company of Duluth, Minn., is preparing to extend its system to Smithville, New Duluth and Fond du Lac.

The Minnesota Central Telephone company has begun work on an extension of its toll lines from Morris, Minn., to Breckenridge, Minn.

A. L. and T. A. Miller expect to have a telephone exchange in operation at St. Thomas, N. D., by October 15th.

The Northwestern Telephone Exchange company has completed a telephone exchange, with 75 subscribers, at Anoka, Minn.

The Western Electric Telephone company is building a toll line west from Fulda, Minn., to Chamberlain, S. D., and has it about completed.

A telephone toll line is soon to be constructed from Fosston, Minn., to Farris, Minn.

The Wisconsin Telephone company is putting in connections at Clintonville, Wis.

Mr. Greening of Grand Meadow, Minn., is extending his telephone system toward LeRoy, Minn.

Hallock, Minn., is to have an automatic-switch telephone system in operation soon.

Work will be begun on the new telephone system at Elkhorn, Wis., at once.

The Northwestern Telephone Exchange company contemplates improvements to its exchange at St. Cloud, Minn.

The Wisconsin Telephone company will erect a two-story brick building for its central office at Oshkosh, Wis.

The Northwestern Telephone Exchange company is preparing to renew the battle with the Minneapolis druggists on the nickel-in-the-slot instruments, and the operators will receive the same instructions about giving connections to subscribers only which proved so obnoxious to the druggists before. Where druggists will not allow a slot machine in their places, one will be placed in the neighborhood, as near as possible, and the company says what trade the telephone draws will go to the storekeeper who does permit it. The Mississippi Valley company will not make any restrictions on who shall use its instruments.

The Mutual Telephone company of Des Moines, Ia., will begin a campaign to make a material increase in the number of its subscribers, and wants to have 2,000 instruments connected within a few months.

Robert R. Landon, a graduate of the electrical engineering department of the state college at Ames, Ia., has been sent to Berlin, Germany, to install a telephone exchange there.

It is said that J. C. Hubinger of Keokuk, Ia., recently made an offer of $65,000 for the Mutual Telephone company's system in Des Moines, Ia. It was refused, as the company is earning five per cent. on a capitalization of $300,000.

The Iowa Telephone company is entirely rebuilding its line between Waterloo and Dubuque, Ia.

The central office of the Columbus (Wis.) telephone exchange has been moved to new and larger quarters.

The Mutual Telephone company, which was recently incorporated at Burlington, Ia., will establish an exchange at Moulton, Ia.

The Iowa Telephone company is preparing to establish an exchange at Wapello, Ia.

C. B. Miller of Clinton, Ia., has arranged for the installation of a telephone exchange in De Witt, Ia.

The Sunset Telephone company of Tacoma, Wash., is arranging for extending its wires to Fern Hill and Larchmont at once.

MANUFACTURERS AND DEALERS.

The Kokomo telephone goods are neatly illustrated and described in a catalogue that is being distributed by the Kokomo Telephone and Electric Manufacturing company of Kokomo, Ind. Among the apparatus described are transmitters, subscribers' instruments, switch and toll-line boards, desk telephones, lightning arrester and cross-connecting boards, extension, magneto and bridging bells, dry batteries, etc.

Independent exchanges are all growing rapidly, wherever they are giving service meriting patronage. Fort Dodge, Ia., may be cited as an instance. The Fort Dodge Telephone company has doubled its capacity since last November, when it began business with 300 subscribers. It has just placed an order with the Sterling Electric company for the sixth section of 100 numbers for its switchboard, with distributing board and combined office terminals and protectors.

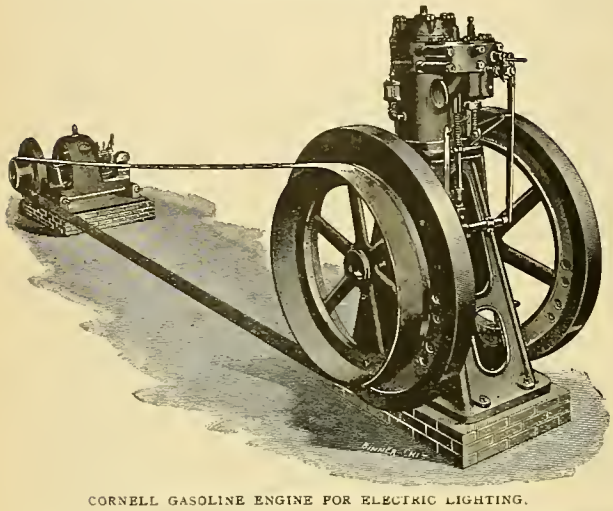
NEW COMPANIES.

The East Tennessee Telephone company has received a franchise and will put in an exchange at Morristown, Tenn.

The Fosston (Minn.) Telephone company expects to have its exchange in running order by October 15th. It promises the very best service.

Cornell Gasoline Engine for Electric Lighting.

For a long time there has been a demand for a satisfactory, simple, compact and cheap direct-belted gasoline engine and dynamo for small isolated plants. In designing the Cornell engine the Cornell Machine company says that its aim has been to meet this most pressing requirement. The outfit that this company is putting on the market is conspicuous for its absence of intricate parts, and the regulation is said to be so perfect and the governor so sensitive that an absolutely perfect light can be attained, even with the plant in the hands of a janitor or porter who has ordinary intelligence. The Cornell engine requires only two valves, and these are of the vertical poppet type. Both are perfectly waterjacketed to protect them from the heat. There is but one cam, which operates the exhaust valve, making the engine free from



CORNELL GASOLINE ENGINE FOR ELECTRIC LIGHTING.

small and delicate parts. The electric igniter is of the wipe type and operated by a rod attached to end of cam shaft.

Not wishing to make claims that would challenge dispute, the company conducted several very exhaustive tests at its factory, resulting (without a single exception) in entire satisfaction. Among other and more exhaustive tests conducted, a 2½ horse power gasoline engine was direct-belted to a dynamo of 1½ kilowatts capacity, and furnished power for 25 16 candle power incandescent lamps at 110 volts 48 hours without a single stop. Hourly records taken from the voltmeter during this test showed less than an average of three-fourths of one per cent. fluctuation, and at no time could the naked eye detect a flicker in the lights. After the expiration of 48 hours a tachometer was attached to the crank shaft, and by shifting from full load to no load, and from half load to full load, the engine was found to maintain a continuous steady speed throughout, as indicated by the tachometer.

The Cornell Machine company offers this direct-belted electrical outfit to its patrons in sizes from 2½ to 50 horse power, with the guarantee that it will furnish a perfectly steady light, and do so at an exceptionally low rate of fuel consumption.

Either gas or gasoline can be used to operate the engine, the company claiming that for every five gas jets burned as fuel in a gas-engine plant, 10 16 candle power incandescent lights can be obtained.

The address of the Cornell Machine company is 175 West Superior street, Chicago.

G. I. Arc-lamp Hanger Reel.

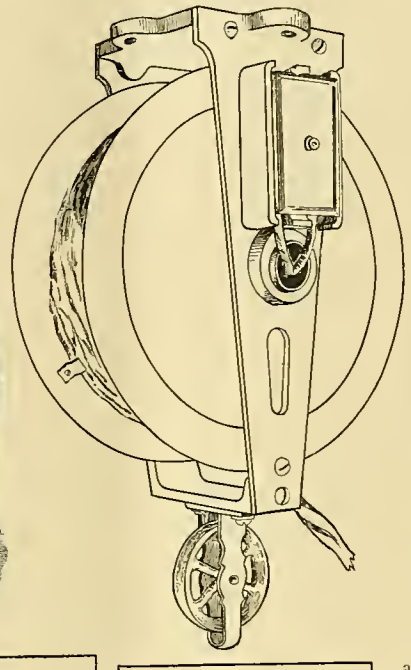
The hanger reel for arc lamps illustrated herewith is recommended as fully covering all the requirements for a self-winding electric reel to feed an arc lamp or similar electric fixture which it is desired to raise and lower for use and for trimming, as in the case where the employment of long step-ladders is objectionable.

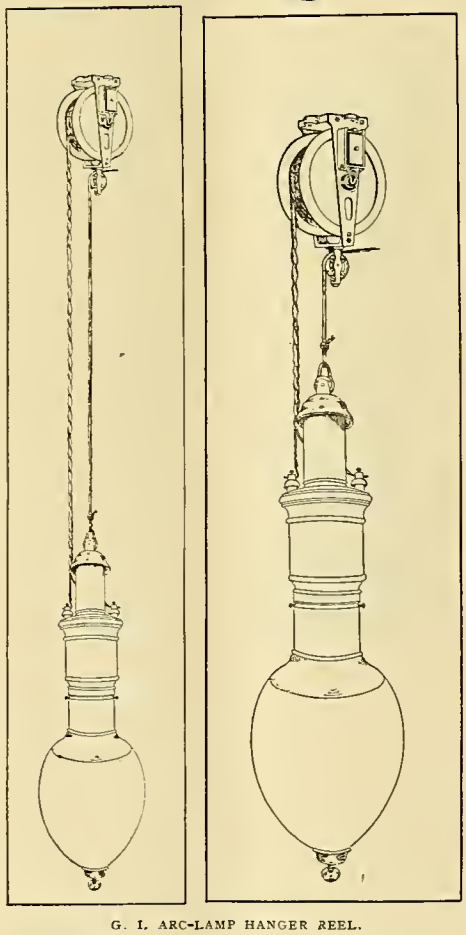
It is of very simple and substantial construction, the drum being of iron, the insulating parts of slate and the current-carrying parts, of course, of copper. It can be used indoors or out, and is fire and waterproof.

The illustrations show the device in both positions (when raised and when let down), and hardly require further explanation. The device consists of a cast-iron drum, supported with iron brackets, as shown, which can be fastened to a ceiling, a wall, a pole or any similar support. Inside of the drum is a strong, tempered coil spring of the proper power to take up the flexible conductor carrying the current, which winds or unwinds on the outside of the drum. On the supporting brackets are mounted the porcelain cutouts required by the underwriters' rules. This appliance is manufactured by the General Incandescent Arc Light company to comply with these rules in all respects.

Electric Railway in the Alps.

Writing from Marseilles on July 12th, Mr. Skinner, the United States consul, says: "I am advised that the Paris, Lyons and Mediterranean Railway company, headquarters at 88 Rue St. Lazare, Paris, has undertaken the construction and operation of an electric railway between Fayet and Chamounix, at the foot of Mont Blanc. The line is to be in operation within 20 months, and it is to be presumed that the company will be interested in propositions for machinery and equipment. Power is to be furnished





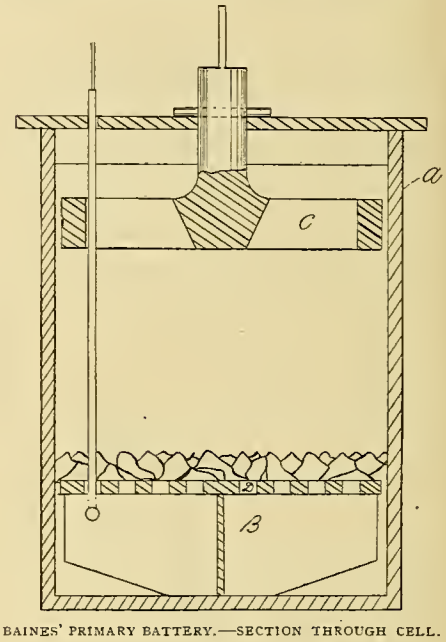
G. I. ARC-LAMP HANGER REEL.

by the River Arve. The cars are to be automobiles, each supplied with its own dynamo. The contract for building the road proper and providing the water power has been divided into two parts and awarded to Gagner & Frères of Annency and Richard & Meynard of Avignon."

Whether it is proposed to use some form of the Heilmann system, with an electric generating plant on each car, or whether the word "dynamo" is used for "motor," meaning that each car is to be a motor-car, is not clear from Mr. Skinner's brief note.

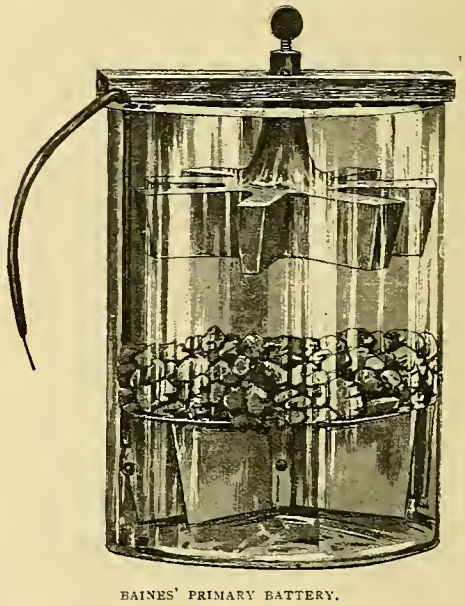
Baines' Primary Battery.

Edward Baines has brought out, under a patent issued July 11th, a new form of gravity battery. Described in brief, the cell has in the bottom of the jar a copper electrode upon which is placed a perforated plate or grid. On this grid is a layer of small and closely packed copper-sulphate crystals, and above, at the top of the cell, is suspended the zinc element. The negative electrode is at all times in a 25 per cent. solution of sulphuric acid containing a small proportion of sulphate of copper,



BAINES' PRIMARY BATTERY.—SECTION THROUGH CELL.

and as this solution is said to have practically no resistance, the current is therefore large and constant. The battery is being manufactured by Baines' Improved Primary Battery company, 594 Broadway, New York, of which William C. Callmann is manager. It is claimed by the company that with ordinary attention the Baines battery will give a current of eight-tenths of one ampere for an indefinite time or more than twice that of the ordinary gravity battery. With proper treatment the battery will not polarize, as sulphate of zinc cannot pass through the crystals of copper sulphate to the negative elec-



BAINES' PRIMARY BATTERY.

trode, and the life of the latter is said to be unlimited, as no copper or refuse is at any time deposited upon it. The grid after use may be sold for more than cost, it is said, owing to the value of the pure copper deposited upon it. The electromotive force of the cell is one volt.

The manufacturers say that this battery is the first scientific and economical improvement that has been made in the gravity battery during the last 40 years, and state further that the Baines battery will not only take the place of the gravity battery now in use in telegraph, fire-alarm and other high-resistance circuits, but will also replace the expensive and troublesome battery now used in electroplating, charging storage batteries, driving motors, etc.

CORRESPONDENCE.

New York Notes.

New York, September 11.—The main things of current interest are that Mr. Edison has a gold-mining machine; the flutter in compressed-air stocks, and that everything is Dewey, Dewey; but this last is no news. Every Broadway hotel is even now crowded to its uttermost. Probably this is due to the Grand Army travelers, but, nevertheless, it is stated that the bulk of the rooms are engaged for the Dewey celebration.

Mr. Edison's new mine, where he will construct a large reduction plant and treat gold electrically, is in the southern part of Santa Fe County, about 25 miles from Santa Fe, New Mexico. According to dispatches, it is the Oritz mining grant that has been sold to friends of Thomas A. Edison for a consideration of about $3,000,000, after much trouble and controversy. It is the intention of Mr. Edison and those associated with him to build a large reduction plant, where he will treat gold ore by his new electric process.

At one time it looked as though compressed air was going to have things all its own way on the crosstown street-railway lines of New York, but this week American Air Power stock, which is traded in on the curb in Broad street, attracted much attention by breaking sensationally from 62 to 52. The stock was offered at the latter figure for a while, and received no bid higher than 48. This break was the result of selling of the same character as that which has been responsible for the stock's weakness during the last few days. Air Power has been forced down from around 70 by persistent selling, believed to be for the account of interests which have combined to bear the stock. Many stories have been circulated to help along this campaign, most of them telling that the company's motor system, which is in use on the Twenty-eighth and Twenty-ninth streets railway, has proven a failure. It is said that owners of property along the line of the road are making vigorous protests against the dirt and the noise caused by the air-motor cars. It is also said that Metropolitan officials are very much dissatisfied with the working of the air motors, and have already signified their intention of replacing the system with electricity, but no basis can be found for these reports.

The electrical features of the Dewey celebration will be very elaborate. A large searchlight will be placed on the Fifth Avenue Hotel and will be used to illumine the Dewey arch and colonnade. The city halls in Manhattan and Brooklyn will be brilliantly illuminated, as will also be Grant's tomb, and the Brooklyn bridge will display electric lights so as to show the words "Welcome Dewey." The letters will be 36 feet long and they will extend for 300 feet.

Corporation Counsel Whalen has gone to Boston for the purpose of inspecting the tunnel that has been put in operation by the Boston subway commission. Upon his return he will present his recommendations in a formal letter to the rapid-transit commissioners. Action will then be immediately taken by the board, and the plans for New York's rapid-transit subway will be revised and completed.

The lives of 200 passengers on a Fifth avenue elevated train were imperiled Sunday afternoon by fire. While the train was running at full speed a sharp report was heard from the front platform and in a few minutes the car was on fire. Before the fire was put out the motor car was practically destroyed and one of the other cars was about half burned. No one was seriously injured.

Jacob Arnberg, an employe of the Metropolitan Railway company, while working in the vault under the tracks of the Lenox avenue under-trolley road at One-hundred-and-ninth street and Manhattan avenue was almost instantly killed by an electric shock on Wednesday last. His forehead came in contact with the conducting rails, which were on either side of and about a foot below the trolley slot, and it is evident that he received the 500-volt current across the brain. G.

Northwestern Notations.

Minneapolis, September 9.—Larimore, N. D., has sold bonds to the amount of $7,000 and will install an electric-light plant.

Professor Zimmer of Hilbert, Wis., has sued the Fox River Valley Electric Railway company for $12,000 damages for injuries received by his being struck by a street car.

Frank S. Walker has sold a controlling interest in the Electric Light and Power company of Darlington, Wis., for $27,000.

The Lewiston (Wash.) Water and Power company has purchased a site on which buildings will be erected for a power plant to run the street-railway system.

It is rumored at Eau Claire, Wis., that the Wisconsin Central railway may build a second electric line to Chippewa Falls.

There is considerable talk at Maxwell, Ia., of an electric-light plant.

Rockwell & Snider of Chicago were the lowest bidders for an electric-light plant for Waupun, Wis., at $10,558.

The Milwaukee (Wis.) Electric Railway and Light company has plans for the future for an electric-railway system, to run diagonally across the state to West Superior, with branches to Oconto and Marinette. It has been rumored that the company would build a line to Lake Geneva, but this is denied.

A street-car collision occurred on a grade of the Light and Traction company's line in Dubuque, Ia., resulting in a broken leg for one of the motormen.

The Ottumwa (Ia.) Electric and Steam company is rebuilding its tracks on South Market street and making some changes in the lines.

The Electric Light company of Beloit, Wis., is making extensive improvements to its power plant. A new flume is being constructed.

There were 137 permits for electrical work issued this summer in Superior, Wis., of which between 90 and 100 were for new buildings.

The Fox River Electric Railway company of Green Bay, Wis., is considering the extension of its system into the farming country in that vicinity.

Specifications will be prepared by Superintendent King of the police-alarm system in St. Paul for a new police-alarm system.

A bolt of lightning struck the house occupied by the Rev. Mr. Holly in Keokuk, Ia., and carried off a section of the roof, destroyed part of the ceiling of an upper room, splintered the rafters and shingles and forced the corner walls, where the bolt entered, about six inches apart.

A car on the trolley line in Toledo, Ia., became wild and unmanageable, with a crowd of 42 aboard. A collision was inevitable, and 40 managed to escape by jumping. A number were bruised and shaken up, but none was seriously hurt. The car damage will amount to $200.

The council of Fargo, N. D., thinks the Hughes Electric company is taking an advantage of the city and proposes to retaliate by preventing the company from extending heating mains through the streets, to heat buildings from exhaust steam. The city had the contract to pump water for the Northern Pacific railroad, but a difference over the rate arose, and the railroad company (which owns its mains and pumping station) put in an electric motor and pump and pumped water by electricity, which the Hughes company furnished. The electric company claimed that it was a business proposition, and there was no reason why it should refuse the railroad company's business.

W. B. George has applied to the council of Billings, Mont., for an electric-car franchise to the West Side.

The City Park Transit company of Spokane, Wash., has met an invasion into its field by the Spokane Street Railway company by applying to the council for permission to build two lines, both of which will enter the field of the street-railway company.

The General Electric company of Minneapolis will install a large storage battery by October 16th, to cost $65,000. This will equalize the load on the machinery, and will furnish light during a temporary stoppage.

The franchise of the Electric Light and Power company of Marengo, Ia., has been extended by the council, subject to the approval of the voters.

The council of Manchester, Ia., is considering the formation of a new electric-light company and having the system under municipal control.

The city of Stillwater, Minn., is taking bids for furnishing electric street lighting for a term of five years.

The Chippewa Valley Electric Railway company will erect a power station between Chippewa Falls and Eau Claire, Wis., at a cost of about $25,000.

The Home Electric company has been incorporated at Dubuque, Ia., as a reorganization of the Light and Traction company.

The differences of the Citizens' Traction company and the city of Neenah, Wis., have been settled, and the city agrees to make room for the tracks of the company.

Lane & Francis of Chicago will install an electric-light plant for Cuba City, Wis.

The warehouse of the Northwest Engineering company, St. Paul, had a narrow escape from serious loss by fire recently. A five-gallon can of gasoline became ignited and had a big headway before the department arrived. About $300 worth of machinery was ruined.

Ole Hanson, an employe of the Water, Light and Power company of Superior, Wis., wants $20,000 of the company's money as damages for a shock he received from a wire supposed to be insulated, but which was not.

An electric car line, for passenger and freight, is projected between Aberdeen and Hoquiam, Wash.

W. A. Campbell and A. J. McGregor have a franchise at Greenwood, B. C., for an electric-light plant, but it is conditional on its being in by October 15th. They have options for developing water power, but have been delayed, and now have not the time to get the power plant in shape. The council refuses to extend the time and the holders of the franchise say they will put in a steam plant to keep the franchise.

The Electric Light and Power company of Madrid, Ia., has been incorporated to put in an electric-light plant.

The Des Moines (Ia.) city-railroad service was severely crippled lately by an accident in its power house. A few days previous, in a severe electrical storm, it had 17 cars burned out.

A. T. Jenks was the lowest bidder for furnishing electric street lighting for Stillwater, Minn., at $4,225 per annum. As he is connected with the Electric Light and Gas company, the latter will probably carry out the contract if it is awarded to him. R.

PERSONAL.

Jacob Loomis, president, and H. H. Thacker, secretary, of the Lea Manufacturing company of Elwood, Ind., were in Chicago early in the week.

Mr. F. E. Drake, the director of machinery and electrical exhibits for the American section at the Paris Exposition, has returned from France. He says that the exposition outlook is most promising, and that the Dreyfus affair will not injure the exhibition.

Colonel Albert D. Shaw of Watertown, N. Y., the new commander-in-chief of the Grand Army of the Republic, is largely interested in the development of electric power at Niagara Falls. Since 1890 he has been president of the Canadian Niagara Power company, which has a lease of water-power privileges within the Queen Victoria Park.

It is stated that Mr. Oscar Moll will be the traffic manager of the new German-American Cable company. For 12 years Mr. Moll was traffic manager of the Direct United States Cable company at London. He will have charge of the German cable extending from Emden, Germany, to the Azores, where it will connect with the section extending to New York.

Luther Stieringer, the expert in decorative lighting, has been appointed consulting engineer for the Pan-American Exposition, to be held in Buffalo in 1901. Mr. Stieringer's work as a designer of electric-lighting effects at expositions, particularly those at Chicago and Omaha, has advanced him to a position of pre-eminence in the line which he has made peculiarly his own.

Colonel Charles A. Munson, manager of the Chicago office of the Fort Wayne Electric Works, has returned from his summer vacation, spent in France, Germany, Austria, Holland and Belgium. Although the trip was primarily undertaken for pleasure, Colonel Munson found the electrical industries on the continent to be in a flourishing condition. Russia, in particular, was deemed to offer a promising field for the introduction of electrical goods by those whom Colonel Munson questioned. In Paris he found the exposition buildings fairly well advanced and giving indication of great beauty. The electrical display promises to be particularly fine, and the interests of the United States are in competent hands.

ELECTRIC LIGHTING.

Douglas, Ga., will construct an electric-light plant.

A new company, known as the New Jersey Light, Heat and Power company, is said to have purchased property for a large electric plant at Mount Holly, N. J.

The property, rights, franchises and contracts of the Huntsville (Ala.) Electric Light and Power company have been transferred to John H. Waters and T. C. Dupont of Johnstown, Pa., for $40,000.

The Spartanburg (S. C.) Railway, Gas and Electric Light company has been incorporated, with a capital stock of $150,000, by P. H. Gadsden and William Austin of Charleston, F. H. Knox of Pittsburg, Pa., and others.

The McKeesport (Pa.) Times states that the Monongahela Light and Power company, that now has control of most of the electric-lighting, heat and power plants in the Monongahela Valley, has commenced excavating for a large power plant at Rankin.

The acetylene-gas plant that now lights Mount Kisco, N. Y., is to be supplanted by an electric-light plant. A franchise and a five-year contract have been awarded to the Mount Kisco Lighting company of White Plains, which will soon begin operations.

The St. Petersburg (Fla.) Electric Light and Power company has been incorporated, with a capital stock of $13,000, for furnishing light, power or heat by electricity. Frank A. Davis, E. Irem, C. Davis, George B. Creveling, A. P. Weller and L. Y. Jenners are the incorporators.

W. B. Smith Whaley and associates have purchased the property of the Columbia (S. C.) Street Railway, Light and Power company for $257,500, and will begin at once the renovation and reconstruction of the plant, installing new machinery for supplying additional power.

Waukegan, Ill., has had considerable trouble in obtained electric light for the city, and a short time ago the local company that was furnishing the lights shut them off entirely, pending a satisfactory settlement of the controversy. It is understood that the matter has been amicably settled now by a year's contract with the company being passed by the City Council providing for a rate of $78 a year for each arc lamp for all-night service.

ELECTRIC RAILWAYS.

The British Columbia Electric Railway company of Vancouver is spending about $400,000 in extending and improving its local lines.

The City and Suburban Railroad company of Washington has completed its electric line to Eckington and is successfully operating the road.

The Chicago and Milwaukee electric road has been completed through Kenilworth and Glencoe, and through trains are now running between Evanston and Waukegan.

H. L. McKee, Walter H. Harrison, W. W. Draper, S. Crowley and others have incorporated the Atlanta and Roswell Electric Railway and Power company at Atlanta, Ga., with a capital stock of $500,000.

The Wellsburg (W. Va.) Herald states that the City Council has granted a franchise to the company proposing to build and operate an electric street-car line through Wellsburg, Lazearville, Midway, Bethany, West Liberty and Wheeling.

The Latrobe Street Railway company of Latrobe, Pa., has been incorporated, with a capital stock of $18,000, to construct a street railway at Latrobe. The incorporators of the company are J. M. McFadyen, J. B. Anderson, J. Peters, J. C. Head and J. Eaton.

The Benton Harbor (Mich.) Council has granted William C. Hovey a franchise to construct and operate an electric street railway in that city. It is said that the road will be extended along the lake shore to Paw Paw Lake, South Haven and other points.

Reading (Pa.) street-car employes asked for an advance of 10 per cent. in their wages some time ago, but received no answer. The City Council, believing that the men are too poorly paid, has passed resolutions setting forth that the men ought to get the increase.

The General Electric company has secured an injunction against the Cleveland, Berea, Elyria and Oberlin Street Railway company of Cleveland, O., restraining it from using motor and controller equipments on its cars which are adjudged an infringement on the Condict patent (No. 393,323) for series parallel controllers.

The Lima, Toledo and Cincinnati Railroad company was recently incorporated, with a capital stock of $250,000, to build an electric railroad north and south through Ohio, through the counties of Montgomery, Miami, Shelby, Auglaize, Allan, Putnam, Henry, Wood and Lucas. The road will probably be 143 miles long from Toledo south to Dayton.

The Easton Street Railway company, capitalized at $40,000, and the Stoughton and Randolph Street Railway company, with a capital of $80,000, have been incorporated in Massachusetts, each having the following-named directors: Edward F. Draper, John McCarthy, Marcus D. Urann, Samuel K. Kelly, E. M. Howard, Edward C. Jenny and Amasa Heath.

It is stated that San Jose and Alviso, Cal., may be connected by an electric passenger and freight railway. Bids for the sale of the franchise will be received until September 18th. The Alum Rock motor line may be changed to an electric road, and it is said that an electric railway from San Jose to Las Gatos via Campbell is also being considered.

Some little excitement was caused one evening recently by a broken wire on a South Side elevated-railroad car in Chicago. The "pig-tail" wire leading from the contact shoe broke and short-circuited with the truck, causing a little fire at the end of one of the coaches. The fire was quickly extinguished and the resulting loss was only nominal.

New York financiers have formed a syndicate to unite with the Southwest Missouri Electric Railway company, operating at Joplin, Mo., to extend this interurban line to Central City, Empire, Duenweg, Oronogo, Neck City and other mining camps in the Missouri-Kansas zinc belt. The road is to be standard gauge and will be used for freight as well as passenger traffic.

A street-railroad deal is said to be on foot in New York state, involving all the roads in Albany and Troy, which will give the consolidated company a monopoly of street-car traffic from Albany to Lake George on one side of the Hudson, and from Albany and Troy to Sand Lake, N. Y., and Bennington, Vt., on the other. Anthony N. Brady is said to be prominent in the negotiations.

The West Elizabeth and Dravosburg Street Railway company of West Elizabeth, Pa., has been incorporated, with a capital stock of $42,000, to construct an electric railway from West Elizabeth to Dravosburg. The following-named are the incorporators: A. M. Pierce, A. P. Dean of West Elizabeth, A. G. Wilson of Coal Valley, S. A. Bryce and R. M. Curry of Elizabeth.

The Valley Railroad company of Bingham, Utah, has been incorporated with a capital stock of $200,000, to construct an electric railway from the suburbs of Salt Lake City to Bingham, 14 miles distant. The officers of the company are: President, James Campbell; vice-president, Edmund Wilkes; secretary and treasurer, Henry C. Rollins. The directors are James Campbell, Edmund Wilkes, Henry C. Rollins and William C. Hall of Salt Lake City, and Arthur S. Cook of San Francisco.

J. Winter, D. W. Simons, F. C. Andrews, O. H. Lane, J. W. Smith and J. H. Andrews are the incorporators of the North Detroit Electric Railway company of Detroit, capitalized at $50,000.

The Port Huron and Port Austin Electric Railway company of Detroit has been incorporated, with a capital stock of $25,000, by M. A. McCarron and F. H. Cranford of Detroit and F. T. Sinclair of Port Austin.

Houghton County, Mich., is to have an electric railway, with headquarters at Hancock. The company, which will commence building the road next spring, was recently incorporated as the Houghton County Street Railway company, with a capital stock of $25,000. The incorporators are F. J. Bawden, C. A. Stone, E. S. Webster, W. C. Forbes, R. L. MacDuffie, W. C. Chapman and W. H. Taylor.

The work of constructing a trolley line from Lansdale to Perkasie, in Eastern Pennsylvania, has been commenced, and the company expects to have the line in operation by fall. A power house will be erected at Souderton. The road will pass through the boroughs of Hatfield, Souderton, Telford and Sellersville. It is proposed to extend the line to Philadelphia by the way of Norristown and Chestnut Hill.

It is asserted that an eastern syndicate has taken 60-day options within the last few days on all the street-railway, electric-light and artificial-gas interests in Beaver County, Pa. It is the idea to operate all these plants in common. The capital of the big concern will be $4,000,000, if the scheme materializes. It is practically the concluding step to the building of the long-talked-of electric line from Pittsburg to Newcastle, a distance of 53 miles.

During the last few months the Long Island railroad has equipped a portion of its Jamaica Bay route for the operation of electric cars, in combination with the regular steam equipment. Power is being furnished by an electric-light and power company at Far Rockaway, alternating current being transmitted to different points on the line, where it is transformed by rotary converters to a direct current of 575 volts. A storage battery of 252 cells, located 4¼ miles from the power station, will operate in parallel with the power-house machinery.

It is now possible to travel from New York to Boston by trolley cars with only one short break in the entire distance, and, if present plans do not miscarry, it will soon be possible to travel in the same way from Philadelphia to Harrisburg, Gettysburg and Baltimore. Already one can travel all over the eastern section of New Jersey and the western section of Long Island by trolley lines, and it is only a question of a short time when one can travel from New York to Albany, Troy and Saratoga by the same means.

The building of the first high-speed railroad operated by electric power on the system devised by Mr. F. B. Behr, a well-known electrician, between Liverpool and Manchester, is under consideration, and it is stated that there will be little difficulty in raising the capital needed. A committee of the Liverpool Chamber of Commerce has reported favorably on the project, and contractors of high standing have put in estimates and bids for the construction of the line. It is claimed that the distance of 30 miles can be covered in 20 minutes.

The Hanover (Mass.) Street Railway company, a consolidation of the Rockland and Abington, Braintree and Weymouth, Bridgewater, Whitman and Rockland, the Hingham and Hanover Street Railway companies, has changed its name to the South Shore and Boston Street Railway company. The capital stock of the consolidated company is $600,000. The company will operate through cars from Bridgewater, Whitman, Rockland and Weymouth to Braintree Station, to connect with the New York, New Haven and Hartford railroad express trains.

Depreciation of property values through the construction of the downtown elevated loop is the basis of another suit filed recently in the Circuit Court of Chicago, asking $100,000 damages from the Union Elevated Railroad company. The Chicago Carpet company is the plaintiff, and the action rests on the alleged depreciation of the premises at Monroe street and Wabash avenue, occupied by the carpet company, through the presence of the elevated structure. The charges that the structure shades the building, obstructs the free entrance to the premises and has lessened the rental value of the place are relied on to sustain the claim for damages.

The work of constructing the Greenbush and Nassau or the Albany and Hudson (N. Y.) electric railway is progressing rapidly. At a recent meeting of the stockholders James Purcell of Valatie, Morris Hoopes of Albany, ex-Lieutenant-governor William F. Sheehan, R. A. C. Smith, H. G. Runkel and John E. Borne, president of the Colonial Trust company of New York; A. M. Young of Waterbury, Conn.; Charles Cooper of Brooklyn and Frederick J. Collier of Hudson were chosen directors. The directors organized, electing the following-named officers: President, Charles Cooper; vice-president, William F. Sheehan, secretary, R. A. C. Smith, and treasurer, A. M. Young. The company is capitalized at $150,000. When the railway from Hudson to Rensselaer is completed it is expected that the road will be made to connect with the Troy and New England road by the way of Bloomgrove and Albia.

Chicago and Joliet, Ill., may be connected by an electric railway line soon. Plans are said to be under way by which it is expected to continue the Joliet railroad from its terminus at Lockport through the townships of Lockport and Dupage, along the Romeo road to the Cook County line. It is the purpose of the Joliet company to connect at Lemont with the proposed line of the Chicago and Des Plaines Valley trolley road, for which a franchise has been granted. E. A. Cummings and H. G. Foreman are among the Chicago capitalists who are said to be interested in the enterprise.

TELEGRAPH.

General Otis has ordered a court of inquiry to determine the responsibility for the loss of the cableship Hooker, which was wrecked recently on a reef near Corregidor Island. The vessel was a total loss and has been abandoned. The telegraph cables, instruments and supplies which she carried were saved. The cables are intended for service between the various islands of the Philippine group, so as to connect the more important with Manila.

AUTOMOBILES.

There has been incorporated, under the laws of New Jersey, the United States Motor-vehicle company, with a capital stock of $1,500,000. The incorporators are Cornelius J. Field, Willard P. Reid and Frank Harvey Field.

A line of electric omnibuses has been started in Berlin, Germany.

The Twentieth Century Automobile company of Cleveland has been incorporated with $10,000 capital stock.

Chicago capitalists are planning to convert a large carriage factory in Milwaukee into a plant for the manufacture of automobiles.

In the recent German army maneuvers automobiles were used in transporting provisions and ammunition and were found serviceable on paved roads in Würtemburg, even on the steepest grades.

The automobile is becoming very popular in London and the capacities of the English and French motor-car factories are being taxed to their utmost to supply the demand for the vehicles.

A report from Port Jefferson, L. I., says that an old rubber factory at Setauket, which has been shut down for some time, has been purchased for an autotruck factory and that it will be equipped at once for the manufacture of autotrucks and automobiles.

A dispatch from Jersey City, N. J., says that a new motor-carriage company is forming in that city and will be incorporated with a capital of $250,000. There will be manufactured trucks, delivery wagons and carriages, with appliances invented and patented by J. W. Walters of New York.

Consul-general Goodnow says that Shanghai is an ideal place for motor vehicles. The town is level, with macadamized roads, and the climate is such, especially in the summer, that everybody drives. There are nearly 500,000 Chinese in the settlements, and they take very kindly to American mechanical inventions as soon as they see them. There are no street railways in Shanghai, and there is evidently a good field for the automobile, as the city is growing rapidly and need is felt for more rapid transit.

One of the social events of the season at Newport was the automobile parade which took place on September 7th. It was arranged by Mrs. Stuyvesant Fish, Mrs. Herman Oelrichs and Mrs. Oliver Belmont, the last-named leading the parade. Eighteen automobiles took part and they were all elaborately decorated with floral and electrical designs. An interesting feature of the event was a driving contest on an avenue filled with all sorts of obstructions. Mrs. Oelrichs and Mr. M. M. Shoemaker won first and second prizes respectively for the skillful manipulations of their vehicles.

POWER TRANSMISSION.

J. F. Wilson of Milledgeville, Ga., and the American Pipe Manufacturing company, No. 112 North Broad street, Philadelphia, Pa., are reported to be interested in the proposed building of an electric power plant at Furman's Shoals, Ga. About $400,000 will be expended on the plant and the erection of factories.

The Chicago Drainage Canal Board has, for the present, abandoned hope of leasing the water-power rights at Lockport and Joliet. The Economy Light and Power company has withdrawn its bid of $4 a horse power a year, and it is likely that the bid of Clarence Buckingham will also be withdrawn on account of the conditions imposed by the board since the bids were opened.

PUBLICATIONS.

The Star Dynamo Works of Jefferson City, Mo., issue a pamphlet describing their direct-current, bipolar dynamos and motors. The company also handles switchboards, rheostats, voltmeters, amperemeters and enclosed arc lamps.

The Western Electric company has in stock a complete assortment of the Bryant Electric company's specialties, and is distributing new catalogues descriptive of these goods to the trade. The catalogues will be sent to anyone on application to the Chicago office of the company.

The Buckeye Electric company has recently made large shipments of its specialty, the Buckeye incandescent lamp to Mexico and Japan. It is the intention of this company to increase its output capacity to 10,000 lamps a day. By October 1st the output of the plant will be at the high-water mark.

Klemm & Co., Fifth and Cherry streets, Philadelphia, have now on the press a most interesting and complete catalogue of reflectors and shades of all kinds for both electric lights and gas. Klemm's patent adjustable reflector is believed by the manufacturer to be one of the cheapest and best reflectors for illuminating show windows and art galleries, and Klemm's adjustable shade for flat-top desks is another specialty that is in great demand. Purchasers of such a line of goods and supply houses in general will do well to place on file Mr. Klemm's new catalogue, as it illustrates a surprising number of specialties and novelties in the reflector line.

"Westinghouse Gas Engines" is the title of a particularly handsome catalogue that is presented by the Westinghouse Machine company of Pittsburg. It is a 70-page book and is filled with interesting and valuable matter concerning the company's gas engines. The illustrations are exceptionally fine and show every detail of the machines. In publishing this catalogue the Westinghouse company has sought to give a brief but explicit explanation of the construction and operation of its gas engines. The cycle of operations is clearly described, and the pictures show the position of the valves and piston at the periods of induction, compression, ignition and expansion and exhaust. Thus one may obtain very good knowledge of the Westinghouse gas engine. Regulation, automatic starting, testing, consumption of fuel and water and the comparison of gas and steam engines are also treated.

MISCELLANEOUS.

A heavy thunderstorm in Paris recently did considerable damage at the exposition grounds. A portion of the machinery building was unroofed and the electric-light plant was damaged.

Among the Chicago personal-property assessments of this year are these: Chicago Edison company, $1,250,000; Western Electric company, $1,134,611; Commonwealth Electric company, $600,000.

The Navy Department has awarded the contract for the six electric cranes for the New York navy yard to the Morgan company of Alliance, O., and the Niles Tool Works of Hamilton, O. The total cost of the six cranes will be $35,080. No decision has yet been reached on the bids for the power plant.

It is stated that the Standard Oil company will introduce electricity as the motive power in place of steam in its works on Newtown Creek. The expense of the change will be $30,000, and if the experiment is successful electricity will be used for driving pumps and operating machinery in the other works of the company.

Experiments with wireless telegraphy have been made at the Blue Hill (Boston) Observatory recently by the use of kites. Signals were successfully transmitted between stations three miles apart. The experiments were based on the Marconi system and a Marconi transmitter was used, copper wires being attached to kites at both stations, instead of to masts, as in the Marconi experiments.

A Boston man is credited with saying that inside of the next five years investigation will show that electrolysis has practically destroyed every high-pressure water and gas line in every city in the country. He says the iron pipes will be replaced with glass pipes, and makes the prediction that seven years from now nothing will be used for underground piping of all kinds where high pressures are carried except glass.

The San Juan and Rio Piedras Railway company has been incorporated at Albany, N. Y., to operate an electric railway and furnish electric light at Porto Rico. The company expects to operate the first electric-railway and electric power plant on the island. It has purchased a steam road eight miles long, and electricity will be substituted as a motive power, the overhead-trolley system being used. The work of reconstructing the road has been begun. San Juan will also be furnished with arc and incandescent lights.

During a recent thunderstorm in Berlin curious effects were produced by the lightning on the persons who were struck. Some of the stange freaks performed are described as follows: "None of the wounded has extensive burns; the wounds look as if caused by a charge of grain shot. The holes reach to the bone and are surrounded by a web of blue and brown lines. Many of the injured have quite a number of such wounds in their feet and ankles, while others got off with a skin covered with blue and brown marks, as if beaten with a thick stick."

The Railroad Telegrapher says: "A British firm has just published the Electrical Inkless Printer, which is said to be the first permanent publication printed by electricity, by direct positive method and without ink or rollers. Of course, the journal is devoted to an exploitation of the method, which, it is claimed, will effect a saving of 30 per cent. even if used in connection with machinery now in vogue." It would be interesting to know if this refers to an X-ray method of printing.

Wireless telegraphy is to be given an exhaustive test on the ships of the United States navy, probably under the personal supervision of Marconi himself, and if the test proves satisfactory the system will be adopted for signaling purposes. Negotiations have been in progress for some time to secure instruments which had Marconi's approval, and now Rear-Admiral Bradford, chief of the Bureau of Equipment, has been notified that the desired instruments of Marconi's make will not only be furnished, but the inventor himself will come over to install the apparatus and supervise the preliminary tests.

It is stated that Thomas A. Edison has completed an electric gold-extracting machine with which he claims to solve the problem of gold mining without water. The machinery, it is said, is now packed and ready for shipment to Santa Fé, where it will be erected and started. Mr. Edison is reported as follows: "I am the patentee of the process, but my only interest in the Calestro company is my employment as its expert. I expect to go to New Mexico to superintend the construction of the plant. We shall begin work almost at once. At the start we shall produce $10,000 worth of gold every day. There is $800,000 worth of it there. The electric machinery will take it directly from the sand. There will be no transportation of the ore. We shall handle it all on the spot and merely ship the pure gold."

TRADE NEWS.

The St. Louis office of the Siemens & Halske Electric company of America has been removed from 6 Laclede building to 116 Laclede building. Mr. W. R. Mason is the sales agent in charge of this office.

The New Excelsior Dry Battery company has removed from Mount Vernon, N. Y., to 661-663 Hudson street, New York city, where it will be pleased to have its customers call and make personal investigation of its batteries.

Trotter's Mona Manufacturing company, manufacturer of the well-known Mona commutator compound, has removed its offices from 65 West Broadway to more commodious quarters at 320 Broadway, New York, where Professor Trotter will be pleased to receive his friends and all interested in commutator compound. Samples of his compound will be mailed free on application.

The Australian General Electric company of Schenectady, N. Y., was incorporated recently with a capital of $50,000 to deal in electrical apparatus and construct electrical plants in the United States and on the continent of Australia and other foreign countries. The directors are Edgar A. Carolan, Edward Clark, James O. Carr, Henry W. Darling, Harold Footman, Elmer E. Gilbert and Myron F. Westover of Schenectady.

The Henri Nestle company, manufacturer of Nestle's food, is establishing a large plant at Fulton, N. Y. This plant will be fireproof and of the most modern construction, using steel framework for the floors and roofs, with brick sidewalls, the floors being constructed of concrete supported by steel beams. The Berlin Iron Bridge company of East Berlin, Conn., furnished and erected all the steel structural work connected with this building, under the supervision of Mr. H. J. White, consulting engineer for Henri Nestle.

A reliable alternating-current switchboard voltmeter has been produced, it is claimed, by the Stanley Electric Manufacturing company. The voltmeter operates on the principle of attraction and repulsion between electrostatically charged parts and has a guaranteed accuracy of 1.5 per cent. It is said to be absolutely free from effects due to the frequency used or to wave form of the generator, and is practically dead-beat, the pointer coming to rest very quickly. No step-down transformer is required, and the scale can be calibrated to read either the primary voltage, to which the voltmeter is directly connected, or the secondary voltage, at which the lamps are operated. The instrument is not disturbed by external magnetic fields and has no magnets, coils or other parts liable to change position or character and thus affect the readings. All the working parts are mounted on hard rubber, securing the best insulation. The Western Electric company of Chicago is the western agent for these voltmeters and has issued a bulletin describing them in detail. The instruments are carried in stock for use on 1,000 and 2,000-volt circuits, the scale of the former having a range from 750 to 1,400 volts, while the scale of the 2,000-volt instrument has a range from 1,400 to 2,800 volts.

BUSINESS.

The Dexter Safety Deposit company, Dexter building, Chicago, recently purchased a 100-kilowatt Western Electric belted generator. The construction department of the Western Electric company installed the generator and switchboard.

The Electric Appliance company, Chicago, is western selling agent for the two-ball cord adjuster or incandescent-lamp hanger. The company states that for the last year each month's sales of this adjuster has shown an increase over that of the previous month

The shooting in Iowa, Minnesota and South Dakota this year promises to be very good, as the rainfall in all these states was abundant. The best localities for chicken and duck shooting are said to be on and tributary to the lines of the Chicago, Milwaukee and St. Paul railway. A copy of a recent publication issued by the passenger department of that road can be had on application to George H. Heafford, general passenger agent, Chicago, Ill., by enclosing three cents in stamps for postage.

The Wybro Hendy company, San Francisco, Pacific coast representative of the Bullock Electric Manufacturing company of Cincinnati, reports a marked increase in business. The company has recently procured a contract from the Oakland Transit company for an 800-kilowatt street-railway generator, directly connected to a cross-compound Corliss engine to be operated at 70 revolutions per minute. This is said to be one of the largest machines ever shipped to the Pacific coast and it will open a new era for the Bullock company.

From all accounts, the Garvin Machine company of New York is "making hay," so to speak, "while the sun shines." Secretary F. W. Garvin said recently to a representative of the Western Electrician: "We are simply overwhelmed with orders." The Garvin Machine company always has an extensive stock of machine tools of the most varied description, and the present rush of business is one of the best indications of what might be called "the expansion at home." Factory managers contemplating extensions will make no mistake in placing the Garvin catalogue on file.

Chicago space is valuable when earth, and not a very good quality at that, is estimated by the front foot. When viewed in this light, and where warehouse space is in demand, it is often better to sacrifice a few articles not entirely in season, but which can be bought by others with more storeroom at figures that will yield a good interest on the investment if held until the proper season arrives. The Central Electric company, Chicago, overestimated the demand on a few sizes of its Central "1899" fan motors, and to make room for winter construction and wiring material is selling these fan motors at prices that are said to deserve attention.

One of the most important problems presented in the equipment of the repair ship Vulcan, which did such excellent service during the recent war with Spain, was that of maintaining an endurable atmosphere in the forge shop and foundry, which were located between decks. The problem was solved by introducing a large steam fan and system of piping. This installation, like that in connection with the foundry equipment, was made by the B. F. Sturtevant company of Boston. The fan was applied to exhaust the smoke from the forge hoods and coincidentally the hot air from the forge shop. It was stated by the officers in charge that "this arrangement proved of inestimable value."

The Western Electrical Supply company of St. Louis reports that its fall trade has opened up better than ever before in the history of its business. The sales of the Monarch lamp have been especially flattering. This lamp has been gradually improved, until to-day it is claimed to be the equal of any incandescent lamp made. It is guaranteed to be absolutely true as to candle power and current consumption. The company also states that its Moloney transformer has established itself as the equal, if not the superior, of anything of its kind on the market. The claim is made that the transformer has close regulation and high efficiency. No expense has been spared in its construction, both workmanship and material being the best that can be had. The company is willing to guarantee the lamp for two years.

George E. Fisher, president and treasurer of the Chase Construction company, general contractor, Detroit, Mich., has secured the contract for his company for constructing the Toledo, Fremont and Norwalk railway, from Toledo to Fremont, O., which includes all work outside of the power house and bridges. The company will employ a force of 200 or more men on this contract when the work is fairly under way, preliminary work having been started last week. Mr. Fisher states that his company has had a very busy season and is now completing the large municipal electric-lighting plant for the city of Grand Rapids and the construction of the Cleveland and Eastern railway at Cleveland, O. This road runs from Cleveland 36 miles east to Chardon, O., and is the second interurban line running out of that city constructed by the Chase company. The company has also just completed and turned over to the owners quite an extensive lighting and power plant, operated by water power, at Belding, Mich., a high-tension, multiphase, alternating system being installed.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 5, 1899

632,252. Rail Bond for Electric Railways. Fred H. Daniels, Worcester, Mass. Application filed June 27, 1899.

A rail bond having a wire rope loop-like body provided with terminals, the sides of the loop being brought together for a certain portion of their length between the terminals and being separated from one another at other points to form openings or eyes.

632,272. Trolley Catcher. Peter D. Milloy, Buffalo, N. Y. Application filed April 29, 1899.

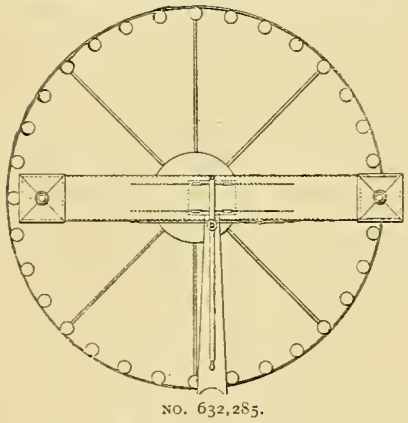
There are combined with a trolley rope feeding and locking mechanism an extension spring, a sheave mounted to rotate above and connected with the spring, the trolley rope passing from the locking feed mechanism to the sheave and thence to the trolley arm, means for extending the spring, spring-actuated dog catches, levers to release same, and a cylindrical casing to inclose the whole.

632,285. Photometer. Walter F. Smith, Philadelphia, Pa., assignor to the United Electric Improvement company, Gloucester City, N. J. Application filed October 15, 1898. Renewed July 25, 1899.

The apparatus combines a housing, internally equipped with a standard light and the accessories of a photometer and provided with normally closed doors, and a carrier provided with means for supporting the lamps to be tested in position for entering the doors, movable in respect to each other, and electrical connections for the lamps. (See cut.)

632,296. Telephone Switchboard and Circuits. Thomas C. Wales, Jr., Newton, and Karl W. Waterson, Lowell, Mass., assignors to the American Bell Telephone company, Boston, Mass. Application filed June 6, 1899.

In a telephone switching system are combined a branch exchange, a main central station connected thereto by trunk circuits, a source of current at the central station connected to the branch exchange by a supply circuit, two divisions of sub-station circuits associated with the branch exchange, both adapted for local interconnection, and one division adapted also for connection with the central station over the trunk circuits, each sub-station circuit extending across the branch exchange switchboard through a call key, a line signal and a series of local connecting keys, and terminating in the current-supply circuit, with a plurality of pairs of switchboard connection conductors, the members of each pair being normally united in series by central-station trunk-circuit connecting keys at one end, in which keys are located the terminals of the central-office trunks, the connection conductors of each pair being provided with branch contacts in the local connecting keys as described, and with branches containing impedance coils extending to the supply conductors leading to the respective poles of the source of current.



NO. 632,285.

632,297. Telephone Number and Address Annunciator. William J. Walsh, Hamilton, Canada. Application filed October 10, 1898.

The annunciator has a series of curved inflexible metallic partitions attached to a case, with a series of weighted flexible sheets provided with stops and index letters upon which are printed the names, numbers and addresses of telephone subscribers, made to move back and forth between the partitions, all constructed and combined to facilitate the finding of telephone subscribers' names preparatory to telephoning, in lieu of the ordinary telephone-directory book now in use.

632,316. Electro-medical Battery. Casteran J. Marius, West Hoboken, N. J. Application filed July 7, 1899.

An electro-medical roller is described, consisting of a core containing a battery, an induction coil and connections and a positive and negative electrode connected therewith and fitting peripherally upon the core for direct contact.

632,346. Insulating Receptacle for Electrical Switches. Jacob S. Gibbs, Hartford, Conn., assignor of one-half to Charles G. Perkins, Hartford, Conn. Application filed May 9, 1899.

A receptacle for snap switches, consisting of a cup of insulating material having a bottom and side walls, with perforations made through the bottom into the interior of the receptacle near diametrically opposite sides, the side wall on the outside of the bottom end of each perforation being removed to form a recess which permits a free bending and manipulation of each of the circuit wires at the back of the receptacle.

632,355. Telephone Transmitter. Tiodolf Lidberg, Chicago, Ill., assignor of one-half to Hal H. Davenport, Chicago, Ill. Application filed December 27, 1898.

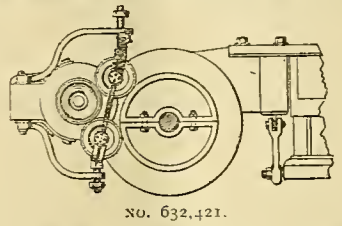
A telephone receiver or transmitter is described having in combination a diaphragm, a clamp around its circumference for securing it bodily in position, two or more springs in opposite zones in contact with the diaphragm between the center and the circumferential bearing thereof, the springs being adapted to exert an outward pressure whereby the diaphragm is displaced in a plane parallel with its normal plane.

632,357. Circuit Controller. Adam Lungen, New York, N. Y., assignor in part to Robert Edwards, New York. Application filed June 13, 1899.

In the controller there are a pair of star-shaped conducting wheels, a pair of contact fingers adapted to engage therewith, a ratchet wheel mounted to turn with the wheels, a pawl engaging the ratchet wheel, a reciprocating plunger actuating the pawl and means whereby the pawl will act upon the ratchet wheel independently of the plunger.

632,380. Trolley Wheel. Edwin R. Stilwell, Dayton, Ohio. Application filed October 24, 1898.

With a trolley wheel, the bore of which is of uniform diameter throughout its length, are combined a bushing having its ends screw-threaded to engage the wheel, the body of the bushing being reduced in diameter to provide a lubricating chamber wholly within the bushing, the end walls of the chamber tapering outwardly to increase the inner longitudinal area of the chamber, and a series of orifices leading from the chamber.



NO. 632,421.

632,415. Automatic Safety Stop for Elevators. James H. Johnson, Newark, N. J., assignor of one-half to William R. Weeks, Newark, N. J. Application filed April 27, 1899.

In an elevator, the combination with the hoistway and the car movable therein, an electric motor, drum and rope for hoisting the car, with appliances for normally controlling the motor, of an auxiliary switch with lever for cutting off the current from the motor, a brake wheel and brake lever for checking the rotations of the motor, an emergency cord directly connecting the switch lever and brake lever, a shifter rod connected by a rope to the emergency cord, a dog upon the car and a block upon the shifter rod arranged in the path of the dog to be moved when the car passes beyond its normal travel.

632,421. Means for Generating Electricity from Car-wheel Axles. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting company of West Virginia. Application filed August 3, 1898.

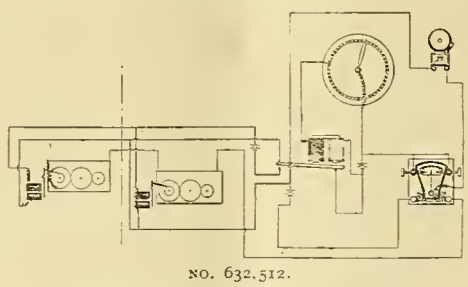
On a car-wheel axle are mounted a driving pulley and a truck frame, and a dynamo is located on the car truck, having an armature shaft, a pulley wheel on the shaft, a frame located between the driving pulley and the pulley on the armature shaft, friction pulleys or idlers in the frame in rolling frictional contact at several points with the driving pulley and the armature shaft pulley and making contact on opposite sides of the central axes of the pulleys. (See cut.)

632,512. Electric Burglar Alarm. Clyde Coleman, Chicago, Ill., assignor of two-thirds to the Bankers' Electric Protective company, Chicago, Ill. Application filed September 28, 1896.

A system is described which has, in combination with a main circuit and circuit-varying devices at the station and guarded structure respectively, electrical appliances including a switching circuit extending to the guarded structure for operating the circuit-varying device at the guarded structure, electrical appliances for operating the circuit-varying device at the station, and means for causing an alarm to be given if the normal condition of the switching circuit extending to the guarded structure is interfered with. (See cut.)

632,513. Electrical Burglar-alarm System. Clyde Coleman, Chicago, Ill., assignor of two-thirds to the Bankers' Electric Protective company, Chicago, Ill. Application filed October 22, 1897.

In this system are combined with the alarm mechanism a housing in which it is disposed, the housing having a door or similar closure, and a main or controlling circuit for controlling the alarm mechanism, the circuit having contacts which are controlled by the door of the housing, and means adapted to be operated from without the housing for establishing the main or controlling circuit through a path which excludes the door contacts.



NO. 632,512.

632,514. Electric Cable. Clyde Coleman, Chicago, Ill., assignor of two-thirds to the Bankers' Electric Protective company, Chicago, Ill. Original application filed October 22, 1897. Divided and this application filed April 10, 1899.

A cable having a plurality of conductors braided together, a flexible insulation surrounding each conductor, and a cementing substance filling the interstices of the insulation.

632,516. Circuit Breaker for Controllers. William H. Conrad, Philadelphia, Pa. Application filed May 17, 1899.

A device for a controller, comprising a spring contact normally resting on a disk of the controller cylinder, an arm forming a continuation of one terminal of the circuit, a latch normally adapted to lock the arm to the spring contact, and a magnet located in the circuit of the controller and adapted to operate the latch to release the arm from the contact.

632,543. System of Electric Traction. Edouard Vedovelli, Paris, France. Application filed May 29, 1897.

In the system described switches are operated by a shunt current, and there are means when a single track branches of placing in series the two ground circuit breakers of the first block of each section of the double track, in such a manner that whatever may be the block that is operated, the ground circuit is broken and the current does not pass to the last block of the single track.

632,546. Means for Giving Alarms Through Agency of Smoke or Other Gases. Henry C. Baer, New York, N. Y. Application filed November 5, 1898.

Means for indicating the presence of smoke or a non-combustion-supporting gas, consisting of a source of heat as a flame, a thermostat acted upon by the flame and included in an electrical circuit, together with a protecting casing wholly surrounding the flame and provided with perforations or openings having a capacity to supply a definite amount of air to the flame.

632,559. Electro-medical Appliance. John A. Freeman, Beard, Ky. Application filed May 10, 1899.

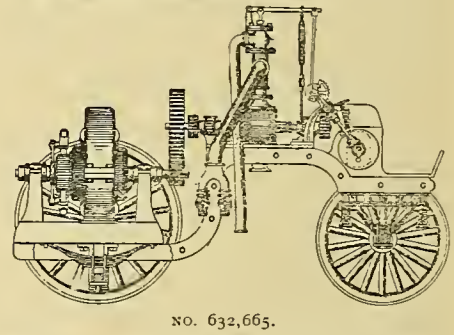
A medical appliance, having an electrode formed with a flexible conducting body member, a conducting-head attached thereto, and a flexible non-conducting tube inclosing the body member and exposing the head.

632,586. Automatic Code Telegraph Fire-alarm Apparatus. Richard Pearson, London, England. Application filed December 7, 1898.

The combination with an electrically operated fire-alarm transmitter and a normally open circuit upon which thermostatic circuit-closers are arranged in multiple arc, the circuit including a releasing electromagnet whose armature normally prevents the action of the transmitter, of an electromagnetically operated circuit-closer at the extremity of the thermostat circuit, a testing circuit including the electromagnet coil of the circuit-closer and a switch on the testing circuit at the station, whereby the current of a battery may be passed through the testing circuit so as to cause the releasing electromagnet to be energized and the operation of the whole transmitter to be determined, and consequently, to enable the efficiency of the transmitter mechanism and that of the thermostat circuit to be ascertained by closing the switch at the station.

632,643. Retouching Frame. John N. Choate, Carlisle, Pa. Application filed October 31, 1898.

One claim reads: In an apparatus for retouching negatives the combination with the frame supporting the negative and having a central cut-out portion, of an electric vibrator arranged contiguously to the opening, an electric circuit and switch, the latter arranged on the outer side of the frame, and a suitable anvil.



NO. 632,665.

632,651. Automatic Car Safety Device for Electric Elevators. James H. Johnson, Newark, N. J., assignor of one-half to William R. Weeks, Newark, N. J. Application filed July 11, 1899.

Some of the essential parts enumerated are an electric motor, drum and rope for hoisting the car, with controller for normally regulating the movements of the motor, an auxiliary switch for cutting off the current from the controller, a safety rope extended in the hoistway and connected to the auxiliary switch and a governor upon the car with clamp actuated by the governor, when rotated abnormally fast, to grip the rope and thus open the switch to stop the motor.

632,658. Electric Rock Drill. George W. Pickett, Denver, Colo., assignor to the Hercules Electric Rock Drill company, Denver, Colo. Application filed October 4, 1898.

An apparatus combining drilling mechanism having a reciprocating movement of its rock-cutting parts, an electric motor having a rotary movement of its armature in one direction, and gearing connecting the armature shaft of the motor with the drilling mechanism and provided with a friction clutch adjusted so as to transmit the power of the motor to the drilling mechanism, but to slip or yield at or about the times when the movement of the reciprocating parts is reversed.

632,665. Electric Fire Engine. William H. H. Whiting, Beachmont, Mass. Application filed January 14, 1899.

Among the parts of the machine described are: An electric motor, an electric controller, a direct-operating rotary pump, suitable induction and eduction pipes, an automatic regulating device and a valve adapted so that its movement shall automatically operate the shaft of the controller through suitable mechanism. (See cut.)

632,666. Commutator-grinding Rig. Fredrick Wilkie, New York, N. Y. Application filed May 25, 1899.

In the grinder is a sustaining yoke adapted for application to a brush arm of a dynamo, the yoke being divided and combined with means for clamping the two parts thereof, for the purpose of maintaining the working parts in place and permitting their adjustment.

632,667. Magneto-electric Generator. Joseph A. Williams, Cleveland, Ohio, assignor to the Williams Electric company, Cleveland, Ohio. Application filed June 10, 1898. Renewed July 26, 1899.

The generator combines with the magnets and the pole pieces contact plates between the pole pieces and the magnets, which plates have sections engaging the magnets and having other sections engaging the pole pieces.

DESIGN.

31,495. Electrode. Asbley D. Scott, St. Louis, Mo. Application filed August 10, 1899. Term of patent 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, SEPTEMBER 23, 1899. No. 13

Lighting, Heating and Refrigerating Plant of the Lessing Apartments.

What is said to be the most complete apartment building in America is situated on the North Side of Chicago, a few blocks from Lincoln Park, at the northeast corner of Evanston avenue and Surf street. It is known as the Lessing Apartments and was built by the E. J. Lehmann estate, which owns several other apartment houses in different parts of Chicago. The building is a five-story Bedford stone, terra cotta and pressed-brick structure, with basement and attic, and is constructed in the form of a large block U, the open court and main entrance facing Surf street. There are 75 dwelling apartments in the building and a large banquet hall is reserved for the exclusive use of the tenants.

In designing the Lessing apartment building the architect, Edmund R. Krause, has paid special attention to supplying all the comforts and necessities of life that one could desire to find in a modern structure of this kind. The apartments are not only lighted by electricity and steam heated, but are also supplied with city, well and hot water, and a system of refrigeration keeps the individual refrigerators in each kitchen cooled. Each apartment is equipped with telephone and call-bell service.

The power house is an entirely separate building and is situated 145 feet south of Surf street. Fig. 2 (p. 173) shows the power house in the foreground, with the apartment building on the left. The former is a brick building 110 feet long and 58 feet wide, and contains the boiler room, engine room, ice room, coal and ash sheds and condenser room. Fig. 3 is a reproduction of a plan of the building and shows the location of the boilers, pumps, engines, etc.

The engine room, which is 40 by 42 feet in size, is illustrated in Fig. 1. By reference to this picture and to the plan shown in Fig. 3 one may readily follow the description. In the foreground (Fig. 1) is a 75-kilowatt direct-current Westinghouse generator, direct-connected to a 13 by 12-inch simple Ideal engine. The dynamo is a 125-volt, compound, multipolar machine, and runs at 275 revolutions per minute. At the right in the illustration is shown another direct-connected unit, the dynamo being a 100-kilowatt, compound, multipolar, 125-volt generator built by the National Electric company of Eau Claire, Wis. It operates at 250 revolutions per minute, and is connected to a 15½ by 15-inch simple Ideal engine. These two units supply current for about 2,500 Buckeye, 16 candle power, 110-volt, incandescent lamps in the main building and power house, and six Moon incandescent arc lamps that are used to light the court and entrance to the apartments.

On the left-hand side of the illustration is shown a 14 by 36-inch 60 horse power simple Corliss engine, built by the Filer & Stowell company of Milwaukee. This engine runs at 50 revolutions per minute and is directly connected to a 50-ton ice machine, known as a Linde double-acting compressor. A system of pipes connects this compressor with an ammonia condenser and the apartment building. In the kitchen of each apartment there is placed a refrigerator, in the top of which is a coil of pipe connected with the mains leading from the ice machine. Ammonia is condensed and forced through all of these coils under 150 pounds pressure and, by direct expansion, not only cools the refrigerators, but also freezes water placed in a tank in the bottom of each one. The ice plant operates about four hours during the middle of each day, or until the water in all the tanks is frozen. One hundred and fifty pounds of ice are thus formed in each refrigerator, which is quite sufficient to maintain a nearly constant temperature at about 40° Fahrenheit until the next day. An auxiliary refrigerating plant is installed in the power house, where 180 15-pound cakes of ice can be made daily. This ice is formed from distilled water and is used for drinking and household purposes, a cake being delivered to each apartment every morning. The ice room is indicated on the plan of the power house shown in Fig. 3. Reb-

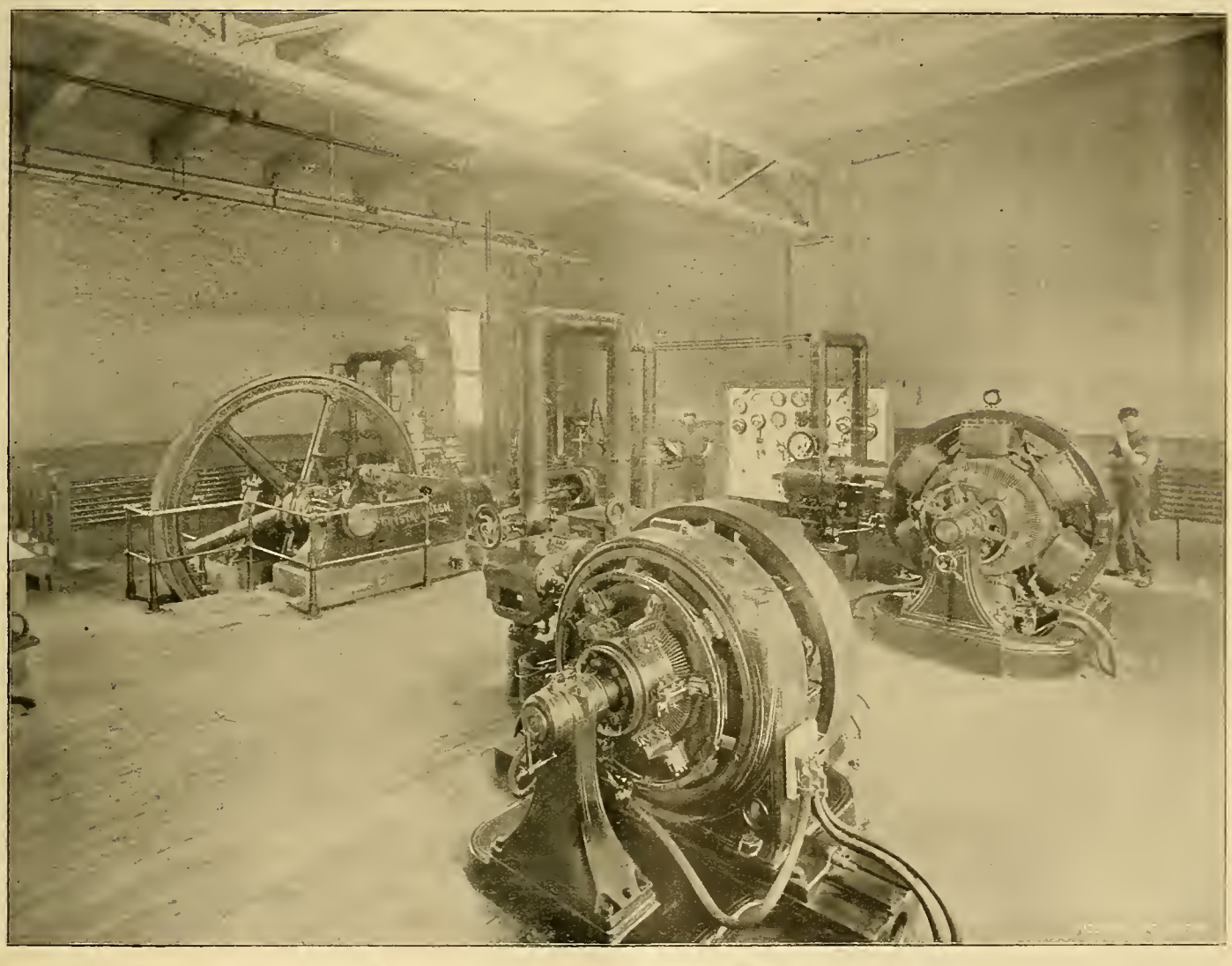


FIG. 1. LIGHTING, HEATING AND REFRIGERATING PLANT OF THE LESSING APARTMENTS.—ENGINE ROOM.

samen & Almeroth of Chicago designed and installed the refrigerating system.

In the boiler room, which is 56 by 58 feet in size, are located the boilers, elevator machinery, pumps, water heaters, piping, etc. There are three 90 horse power boilers of the horizontal tubular type, each 36 inches in diameter and 18 feet long. They were manufactured by the Tobin & Hamler Manufacturing company and are fitted with automatic smoke consumers. The smoke and gases are discharged through a 110-foot brick stack. A steam drum or header, 20 inches in diameter and 18 feet long, is connected by six-inch pipes to each boiler. From this header mains are carried to the engine room, to the pumps and to the hot-water heaters.

A surge tank, 48 inches in diameter and 60 inches high, is placed in one corner of the boiler room, back of the boilers, to receive water from the city mains. Outside of the power house is an artesian well, 1,400 feet deep, from which water is taken for drinking and other purposes. Directly above the well and just below the surface of the ground is a large cistern. To take the water from the well,

and force it into the cistern, the system of Dr. Pohle is used. A five-inch pipe extends down to a depth of 110 feet, inside of which runs a 1½-inch pipe to a depth of 100 feet, both pipes terminating in a heavy "Y" fitting at the top of the well, from which fitting a five-inch pipe is run into the cistern. A 10 by 10 by 18-inch double-acting compressor is used to compress air in a receiver to a pressure of about 40 pounds per square inch. This receiver, which consists of a steel tank 36 inches in diameter and eight feet long, is connected by a 1½-inch pipe to the pipe of the same size in the well. Air under pressure thus forces the water up the five-inch pipe into the cistern above, from which it is pumped to a large tank in the top of the apartment building.

The system of heating used is the Warren-Webster vacuum system, the vacuum pumps being placed in the boiler room to remove the air and condensation from the return mains. These pumps are six by eight by 12 inches in size and are arranged in duplicate, the suction connecting with the receiver on the end of the return and the discharge connecting with a feed-water heater. The exhaust from all of the engines and pumps is turned into a 12-inch header, from which two nine-inch heating mains lead to the building. The heating is accomplished without any appreciable pressure and the vacuum registered is usually about 26 inches.

Two boiler-feed pumps, each 7½ by five by six inches, and a house-service pump 10 by six by 10 inches in size, have their suctions connected with the surge tank, cistern and feed-water heater and their discharge with the boilers and a 5,000-gallon house-supply tank in the main building.

A 400 horse power open feed-water heater and receiver, provided with automatic water supply and overflow valves, is connected with the suction of the three pumps mentioned above, and is supplied with steam from the 12-inch exhaust main.

The domestic hot-water service of the main building is supplied by two heaters, each 36 inches in diameter and 10 feet in length. These heaters are made of steel and each contains 34 two-inch brass tubes. They are operated by either live or exhaust steam and are each provided with a direct-and elevator pipes, the total number being 21. As the tunnel leads from the power house it is seven feet square, but it is reduced at the street to 4½ feet in width and three feet in height, so as to pass over the city sewer.

Fig. 4 gives a view in the boiler room. On the left-hand side of the illustration is seen one of the three boilers and on the right is one of the elevator pumps and the compression tank above it. The two domestic-supply water heaters and some of the pumps show on the back side of the room.

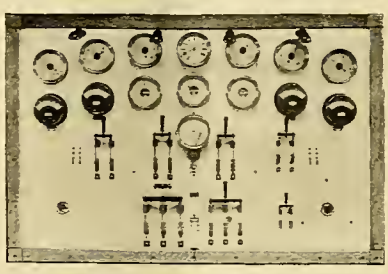


FIG. 5. LIGHTING, HEATING AND REFRIGERATING PLANT OF THE LESSING APARTMENTS.—GAUGE AND SWITCHBOARD.

In Fig. 5 is illustrated the gauge and switchboard. All of the gauges are of the Schaeffer & Budenburg make, and the ammeters and voltmeters are Weston instruments. The two gauges on the left panel of the board are connected with the heating system, one registering the vacuum in the returns and the other the steam pressure. On the center panel the gauge on the left of the clock indicates the boiler pressure, and that on the right the pressure in the air receiver. The three gauges below are connected with the refrigerating system, the center one indicating the return pressure of the ammonia, the other two registering the initial pressure. A Columbia recording steam gauge is placed below. The two gauges on the right panel register the elevator hydraulic pressure and the house water-supply pressus respectively. Three of

In building this power plant the owners of the Lessing Apartments have caused to be erected what is probably one of the most complete power stations of its kind in the country, and as no consulting engineer was employed, the supervising architect, Mr. Krause, is certainly deserving of credit for its design. The plant is under the efficient management of Engineer W. B. Card, and has been operated without a single accident since it was first started, some nine months ago.

Old-time Telegraphers in Boston.

[Correspondence of the Western Electrician.]

Boston, September 15.—The freedom of the city has been extended during the last three days to the Old-time Telegraphers' association and the United States Military Telegraph Corps. These two organizations have been holding their nineteenth annual union convention in the Hub, their respective business sections being scheduled for Tuesday, September 12th, while the other two days were given up to excursions to points of interest about the city and suburbs, the visit to Boston concluding with a banquet at the Hotel Vendome on Thursday evening, September 14th.

Tuesday's business meeting of the Old-timers was called to order in Allston Hall, President H. J. Pettengill of Boston presiding. Former President Samuel A. Duncan of Atlanta, Ga., pinned upon the chairman's coat the insignia of office, a badge bearing the portrait of Professor Samuel F. B. Morse, originally presented by the inventor's family to Hon. James Douglas Reid, and by him given to the association, to be worn on official occasions by the presiding officer.

Mayor Josiah Quincy was in attendance at the opening of the meeting and welcomed the members to Boston. He was made an honorary member of the convention and invested with one of the badges worn by members. In his address he alluded to the fact that Professor Morse was born in Boston, his birthplace being located at the base of historic Breed's Hill, in the Charlestown district.

Captain Louis A. Chasteau of Philadelphia, one of the oldest telegraphers present, a veteran of the Mexican and Civil wars, gave an interesting rem-

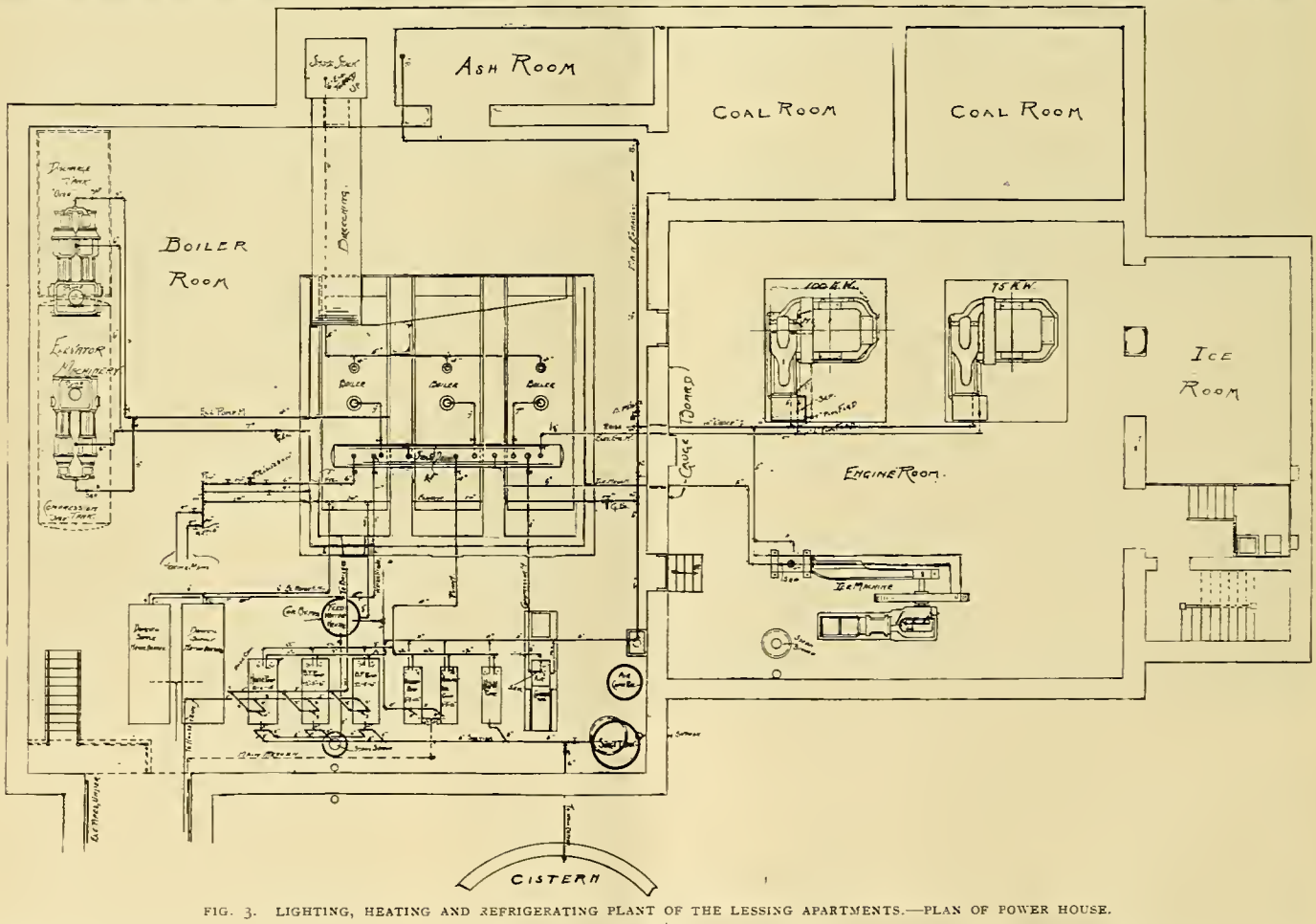


FIG. 3. LIGHTING, HEATING AND REFRIGERATING PLANT OF THE LESSING APARTMENTS.—PLAN OF POWER HOUSE.

contact thermometer and a Johnson temperature regulator.

Three hydraulic elevators, two passenger and one freight, are operated in the building by means of the Crane system. The elevator machinery in the power house consists of two compound pumps and two tanks. Water is compressed in the compression tank to 120 pounds pressure and is returned from the building into the discharge or surge tank. These tanks are placed directly above the elevator pumps.

A brick tunnel leads from the boiler room to the building and is used to carry the hot and cold water, steam and return, ammonia, wire conduit the two-knife switches have a capacity of 600 amperes each, and the other is a 300-ampere switch. The three-knife switches are of 1,200 and 600 ampere capacity respectively. Regulating rheosats and pilot switches complete the equipment of the board. Lounsbery & Eaton were the installing engineers.

The ammonia condenser is situated in the raised portion of the power house, directly above the ice room. It is supplied by a 5¼ by 4½ by five-inch pump, located in the boiler room, next to the air compressor. The boilers, pumps, piping and heating apparatus were installed by Kehm Bros. & Mertz.

iniscent talk of telegraphic work in both periods that came under his own observation.

The report of the secretary showed a net gain in membership of 111 during the year, bringing the total up to 630. The treasury balance was $777.97.

Among the letters received were communications from Superintendent Roche of the Western Union and Superintendent Pillsbury of the Postal Telegraph companies, extending the freedom of their lines to members during their stay in the city.

Action was taken in furtherance of the project of publishing a history of the association, and the Twin Cities of the Northwest, Minneapolis and St. Paul, were selected for the convention of 1900, the

time being fixed as the third Tuesday, Wednesday and Thursday of September. Officers were elected as follows:

President—H. C. Hope, St. Paul.
Vice-president—H. A. Tuttle, Minneapolis.
Secretary-treasurer—John Brant, New York.
Executive committee—James Compton, Nashville; J. J. Dickey, Omaha; Samuel A. Duncan, Atlanta; H. J. Pettengill, Boston.

On the adjournment of this meeting the Military Telegraph Corps assembled in the same hall, President William B. Wilson of Philadelphia in the chair. His address in opening the meeting touched upon the question of recognition by Congress and by the Grand Army of the Republic of the services of the members to the government in the Civil War. In the absence of Secretary James E. Pettit, detained from the meeting by the illness of his wife, H. P. Whitford of Chicago was chosen secretary pro tempore.

Among the letters received was one from ex-President William R. Plum, now abroad, who sent regrets for his inability to be present. The freedom of their lines was tendered by the telegraph companies, as in the case of the other organization. A telegram of sympathy was sent to Secretary Pettit, by special resolution of the members, and a resolution was also adopted favoring the project for a national monument at Washington. Officers were re-elected as follows:

President—Col. William B. Wilson, Philadelphia.
Vice-president—Hon. William M. Ives, New York.
Secretary-treasurer—J. E. Pettit, Chicago.
Executive committee—E. Rosewater (chairman), Omaha; A. H. Bliss, Chicago, Ill.; A. B. Chandler, New York; W. R. Plum, Chicago, Ill.; George C. Maynard, Washington, D. C.; D. Wilmot Smith, Breckinridge, Minn.; R. B. Hoover, Springfield, O.; L. A. Somers, Cleveland, O.; J. D. Cruise, Kansas City, Mo.

Many of the members were accompanied to Boston by their wives, and many points of interest were visited during the time intervening between the business session and the banquet. Visits to Harvard College, Professor Morse's birthplace and the cable station at Rockport, Mass., where they were received by Manager George G. Ward, harbor excursions, and theater parties by special invitation of the managers of several of the leading playhouses, were features of the occasion.

Thursday the city's steamer J. Putnam Bradlee, used for trips to the various city institutions in the harbor, was at the disposal of the party, with Wire Commissioner Thomas W. Flood in charge as entertainer.

The banquet at the Vendome Thursday evening was a brilliant affair. From seven to eight o'clock a reception was held, and at the latter hour the members and their ladies assembled in the dining hall. The after-dinner speakers included President Pettengill of the Old-timers, Stephen O'Meara, Samuel J. Powers, Colonel W. B. Wilson, R. J. Hutchinson, D. J. O'Leary, S. A. Duncan, A. H. Bliss, Walter C. Burton, T. E. Fleming and J. P. Cassidy.

The actual attendance of old-time and military telegraphers was between 150 and 200. B.

The annual stockholders' meeting of the Winchester Avenue Street Railroad company of New Haven, Conn., was recently held, and an entire reorganization of the personnel was effected. The new officers of the road are: President, A. B. Turner, Boston; superintendent and treasurer, A. E. Pond, New Haven; directors, A. B. Turner, Boston; A. E. Pond, New Haven; Sidney Harwood, Boston; A. R. Mitchell, Boston; E. E. Floyd, Boston; S. H. Wagner, I. A. Kelsey, James Graham and H. F. Spencer, West Haven.

Lord Kelvin.

On the occasion of the recent retirement of Lord Kelvin from the University of Glasgow, the University Court adopted a minute expressed in the following terms:

The Court have received with the deepest regret Lord Kelvin's petition for leave to resign the chair of natural philosophy. In granting that petition, as they feel it their painful duty to do, the Court desire to record the sorrow with which they anticipate the close of a service that for more than half a century the university has seen growing in influence and usefulness, and in beneficent application of the inventions of science to the wants of life, to the lightening of labor, to the comfort of the dwelling, to the safety of the traveler by land and sea, to the promotion of the facilities of commerce and the means of human intercourse.

They recall with pride the renown which Lord Kelvin's scientific triumphs have reflected on the university, of which he has so long been the illustrious ornament. They grieve to think that the circle of colleagues and fellow-workers, to whom he has been endeared by the kindness of his heart, the uprightness of his character and the honorable simplicity of his life, must lose the immediate offices of a friendship so highly prized as his. And they beg him to carry with him into his retirement from academic life the assurance of their warm personal regard, of their sincere respect for the fidelity with which he has discharged his duty to the university, of their gratitude for the luster which his achievements have shed upon it, and of their hope that the evening of his days may, under the blessing of God, be prolonged and peaceful.

In expressing his thanks for this felicitously worded address, Lord Kelvin said:

I am deeply touched by the kind expressions regarding my duty to the university during my 53 years' tenure of the chair of natural philosophy. I can truly say that I have always endeavored to the utmost of my ability to act for the good of the students in my class and to maintain the honor and the usefulness of the university; but I feel keenly conscious of many shortcomings, and it is a most valued solace to me on the occasion of my retirement to receive such an assurance of approbation as is now given to me by the University Court.

The happiness which I have enjoyed during 67 years' residence in the university and my treasured recollections of the intercourse and of association in work with colleagues and students make it peculiarly painful to me to cease to be professor and to cease living in the university. But I hope that this double change will not imply anything like total loss either of intercourse or of association in scientific work, and I look forward with some degree of satisfaction to being permanently connected with the university in an appointment as research fellow, for which I have made application to the Senate.

FIG. 2. LIGHTING, HEATING AND REFRIGERATING PLANT OF THE LESSING APARTMENTS.—POWER HOUSE AND APARTMENT BUILDING.

Electrical and Automobile Exhibition at Charleston, S. C.

Believing that the South offers an exceptional field for trade in electrical machinery and appliances of all kinds, automobiles, etc., a number of the leading business men of Charleston, S. C., have formed an organization and will hold a southern interstate electrical and automobile exposition at Charleston, beginning November 21st and continuing four days. The exposition will be the first of its kind held in the South and will not be merely a local affair, but will be sufficiently broad in its scope to attract the attention of the entire Southland. The chief aim of the promoters is to lay before the people of the South a thoroughly comprehensive exhibition of electrical machinery and equipment, automobiles, telephone apparatus and kindred lines. The exposition will be held in the Thomson Auditorium, which covers within its walls 30,000 square feet on ground floor. In beauty, architecture and size it is one of the largest and finest of its kind in the southern states, and it is an ideal place for such an exhibition.

The grounds around the building will be elaborately set for the purpose of the exposition. A handsome electric fountain is to be constructed and numerous other electrical effects will be provided. For the purpose of lighting the great building thousands of additional electric lights will be put in.

Charleston is one of the leading commercial cities of the South, being the outlet for a rich rice and cotton-producing country and a point of supply for an extensive territory embracing South Carolina and parts of North Carolina, Georgia, Alabama, Florida, Tennessee and Mississippi. As favorable arrangements have been made with all the railroad lines leading to Charleston, as well as with connecting lines, thousands of people from the states mentioned will be attracted to the exposition, and no doubt many of them will not be drawn by a desire to see the show merely, but also with the purpose to see and investigate the latest improvements in the electrical field.

Automobile Show for Chicago.

In connection with a large cycle show and race meet that the Arena Athletic Club is planning to hold at Tattersall's in Chicago from September 25th to October 9th, an automobile exhibition is being arranged. It is the intention of the club to devote an hour during each evening's entertainment to an exhibition of the automobiles on the track. A number of motor-vehicle manufacturers have signified their willingness to be represented and a good display is hoped for. One prominent manufacturer in Chicago will show 12 of his vehicles. A showing of private automobiles, to be conducted by the individual owners, will be an interesting feature of the exhibition. Automobilism will also play an important part in the cycle meet itself, as the racers are to be paced by motor cycles. At the close of the exhibition it is planned to have a road race, or, more properly speaking, a road exhibition, of electric vehicles between Chicago and Milwaukee; three charging station on the road are planned.

FIG 4. LIGHTING, HEATING AND REFRIGERATING PLANT OF THE LESSING APARTMENTS.—BOILER ROOM.

The Ohio Valley Electric Railway company has been incorporated at Huntington, W. Va., with a capital of $1,000,000.

Death of J. F. Schoellkopf.

Jacob F. Schoellkopf, president of the Niagara Falls Hydraulic Power and Manufacturing company and also of the Cliff Paper company of Niagara Falls, N. Y., died suddenly at his home on Delaware avenue, Buffalo, on the night of September 15th.

Jacob Frederick Schoellkopf's life is an illustration of the possibilities before men of energy and business enterprise in America. His career is notable among those of the men who have sought fortune on these shores. He was born in Kirchheim-unter-Teck, Germany, November 15, 1819. Until he was 14 years old, he attended the schools in his native town. He then became an apprentice in his father's tannery. For five years he served as an apprentice and then entered a mercantile house as a clerk. He followed this new line of work for two years, during which time his thoughts were turned toward America. In December, 1841, the young German, then 22 years old, landed in New York. He knew nothing of the English language, had no friends, nothing but his trade and his energy to depend upon. For two years he worked at the tanning trade in New York city. In 1844 he came to Buffalo, where he established a small leather store. He started in business with a capital of $800, advanced by his father. Within a short time Mr. Schoellkopf bought a small tannery at White's Corners, now Hamburg, near Buffalo. He made a great success of the tanning business, establishing tanneries in several states.

Not content with his very large interests in the tanning business, Mr. Schoellkopf, in 1857, erected the North Buffalo Flouring Mills. From the first the mills were successful, and at the time of his death Mr. Schoellkopf was one of the largest millers in the state of New York. He was senior partner of the firm of Schoellkopf & Mathews. He was vice-president of the Buffalo, New York and Philadelphia railroad before its sale to the Western New York and Pennsylvania company. For many years he was vice-president of the Third National Bank of Buffalo. At the time of his death he was a director of several banks in Buffalo and Niagara Falls. He was a director and president of the Citizens' Gas company. He was a trustee of the Buffalo General Hospital from the time it was founded. He was a leader in the building of the Niagara Falls and Suspension Bridge railway.

When the Cliff Paper company of Niagara Falls was organized he became its president and has always had a great interest in the paper and pulp business. He was at the head of the Schoellkopf Aniline and Chemical company of Buffalo, and papermakers throughout the country are well aware of the high grade of goods he made.

In 1877 Mr. Schoellkopf's business capacity led him to make a great investment in Niagara Falls, when he purchased the hydraulic canal and organized the Niagara Falls Hydraulic Power and Manufacturing company. Under his supervision and management, and those associated with him, this canal has had a most wonderful development, until to-day it is one of the leading sources of power in the United States. From the time it was purchased until now there has not been an idle moment, so far as extending the development is concerned. Despite his years, only this summer Mr. Schoellkopf purchased Music Hall in Buffalo, and was having it remodeled at the time of his death.

On March 12, 1848, Jacob Schoellkopf was married to Christian Sophie Duerr, whom he knew in Germany, and who, with five sons and a daughter, survives him. One of the sons is Arthur Schoellkopf of the Cliff Paper company and also of the Niagara Falls Hydraulic Power and Manufacturing company. D.

New Method of Generating Electricity Proposed.

Albert Z. Harlan, an inventor residing in Chicago, claims to have discovered a new method by which electricity may be generated at a great reduction in cost. Mr. Harlan states that instead of using mechanical power to successively bring the coils of the armature under the influence of the field-magnet poles of a dynamo, he has devised a means by which the polarity of the pole-pieces is rapidly changed, thus, the inventor thinks, doing away with the great loss of power used in driving the armature.

Happy Electricians at the Clambake.

As there are something like three hundred electrical men represented in the accompanying group picture, it is not to be expected that each face in the illustration should be a clear and recognizable portrait. But each face is serene and happy and all have a common characteristic—an expression of blissful anticipation, for was not the clambake dinner immediately in prospect?

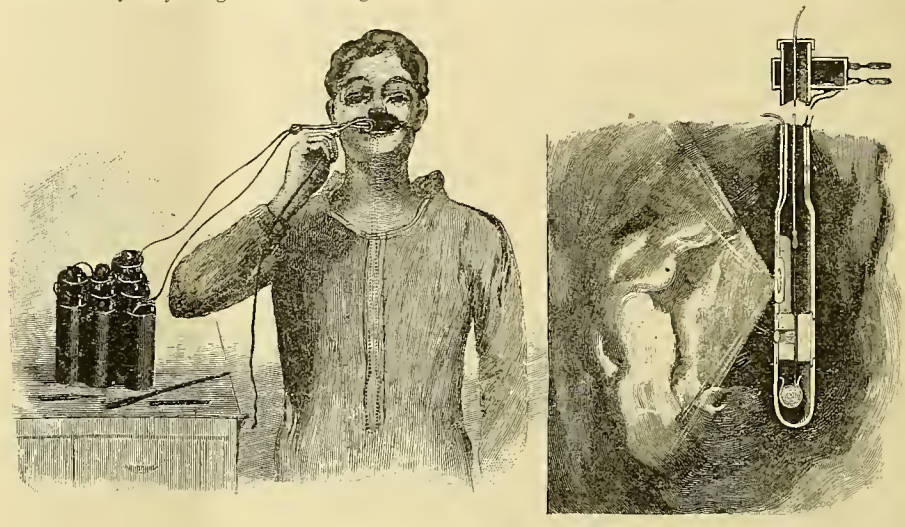
HAPPY ELECTRICIANS AT THE CLAMBAKE.

The photograph was taken at the Pomham Club, near Providence, R. I., on September 9th, and the gentlemen shown by it were the guests of Mr. Eugene Phillips of the American Electrical Works at the annual Phillips clambake. There were 366 guests present by actual count, and if they had a good time before dinner, as their pictures indicate, their beaming looks of satisfaction after the "bake" had been taken unto themselves may be better imagined than described.

Odessa, Mo., has voted in favor of bonds for an electric-light plant.

Photography of the Stomach.

Dr Max Einhorn of New York city made a communication to a medical journal some seven years ago regarding "gastrodiaphany," in which a miniature Edison lamp in a special mounting attached to a soft rubber tube containing a wire was introduced into the stomach, so that an examination can be made of it. This method was called "gastrodiaphany," as the stomach became translucent. The object of this device was to show the size and situation of the stomach to the eye and also to recognize tumors or other gross anatomical changes of the anterior wall of the stomach. This was, of course, a different apparatus than the "polyscope," which is used for looking into the stomach, and was not intended to replace any such device. It has been found to be of considerable value to surgeons.



PHOTOGRAPHY OF THE STOMACH.

In the same paper Dr. Einhorn described a camera for photographing the interior of the stomach, but, owing to technical difficulties, the camera was not constructed by Dr. Einhorn. Such a camera has, however, been perfected by Dr. Fritz Lange of Munich, Germany, on almost the identical lines given by Dr. Einhorn.

Through the courtesy of Dr. Lange, says the Scientific American, from which this article and the accompanying illustration are reproduced, we are enabled to present an accurate illustration of the device employed. The camera is a marvel of compactness, and is constructed on exactly the same principles as all cameras for taking moving photographs, although, of course, there is no attempt made to combine them so as to project the actual operations of the stomach. The camera itself is swallowed by the patient, and it contains a small electric lamp for illuminating the walls of the stomach. A photographic film 20 inches long and a quarter of an inch wide is wound at the bottom of the camera. One end of the film is fastened to the cord, which runs freely in the tube. When the cord is pulled the film is drawn slowly past the lens. The cord and the conducting wires must, of course, be swallowed with the camera itself. When the camera reaches the bottom of the stomach the surgeon begins to pull the cord, which runs the film past the lens. The electric light is then turned on, and, after the sensitive film has been impressed with the image, the current is turned off and another section of film is brought into play until the requisite number of pictures have been obtained; then the entire apparatus is withdrawn from the stomach of the patient and the films are carefully developed and enlarged.

Combined Steam and Electric Railroad for Colorado.

Plans are under way for the construction of a new electric road between Colorado Springs and Cripple Creek, Colo. The object is to give better facilities for handling the increasing traffic of one of the most remarkable gold-mining camps in the world.

The main line from Colorado Springs to Cameron will be operated by steam, but electricity will be adopted from Cameron, where a power plant will be installed, on through and connecting all the principal mines and points throughout the Cripple Creek district, enabling shippers to load their ore direct from mine to cars without long hauls with teams.

The route as laid out will make the line 35 miles long. From Colorado Springs the survey runs through about the same country as the Cheyenne road to the half-way house, and the maximum grade will only be about 3½ per cent. From that point to the Cameron terminus the grade will average two per cent.

Irving Howbert and James F. Burns of Colorado Springs are the promoters of the enterprise.

Niagara Falls Park and River Railway Station Destroyed by Fire.

On the night of Monday, September 4th, the International Traction company suffered a loss by fire through the burning of the power station of the Niagara Falls Park and River railway on the Canadian side at Niagara Falls. The fire broke out about eight o'clock, and, so far as known, was occasioned by a short-circuit on the alternating-current line. The attendant in charge discovered the blaze in the basement, after it had gained a good start there, and he had barely time in which to shut down the wheels, throw the switches and escape from the burning building. The railway company had three 200-kilowatt generators in the station, while the Canadian Niagara Power company had two 750-kilowatt generators of Westinghouse make installed there. All these machines, with their switchboards, etc., were ruined. The total loss is placed at $90,000, on which there was $38,000 insurance. The condition of the plant after the fire is well illustrated in the picture.

As the fire occurred just when the electric railways in and about the Falls were exceedingly busy with summer travel, it was necessary to act promptly if the Park and River railway was to be operated. Recognizing this fact, President Ely, who happened to be at the Falls at the time of the fire, at once set to work, and that night had men make connection between the wires on the Canadian side and those connected with the power service of the Niagara Falls Power company on the New York side, and in this way secured an immediate supply of current for his Canadian line, so that traffic over it was not interrupted but a little while. This is the first time that occasion for this has occurred, but it illustrates most emphatically how fortunate manufacturers at Niagara Falls will be when the Canadian Niagara Power company effects its development on the Canadian side, and makes it possible to throw a power service to the New York side when necessity demands.

RUINS OF THE NIAGARA FALLS PARK AND RIVER RAILWAY STATION.

At this writing the clearing away of the debris of the fire has not commenced, and this is taken by some as an indication that the fire may change the plans of the Park and River railway to the extent of leading it to depend on the New York station for operating current until such time as the Canadian Niagara Power company can get its proposed new plant in operation. However, the necessities of the Canadian Niagara Power company may make such a course impossible at this time.

A Long Electric Railway.

In a dispatch from Toledo, O., it is asserted that H. A. Haigh and S. S. Angus, capitalists of Detroit, have completed arrangements which will give a new electric road from Toledo to Buffalo. The material is said to be on the ground for the construction of the line from Toledo to Norwalk, and that section will be running by December 1st. Mr. Haigh states that the road will be pushed through to Cleveland, and that connections with other electric lines will carry the road to Buffalo. The new system will be in running order by the middle of next June. In connection with this through line spurs will be built, it is said.

At a recent election in New Iberia, La., $110,000 worth of electric-light and waterworks bonds were favorably voted.

Meeting of Western Supply Men.

On Friday, September 15th, a meeting of western electrical supply men was held at the St. Nicholas Hotel, Cincinnati. The meeting had for an object the granting of credits and the promotion of a better feeling among the trade and manufacturers in general. There were altogether about 40 gentlemen present who represented nearly every prominent electrical supply house west of the Alleghenies and east of the Rocky Mountains. Several gentlemen representing the manufacturers were also present.

The meeting was a most harmonious one and its results will unquestionably do much to promote a better feeling among the trade. The visitors were welcomed to the city by Mr. Lawrence of the Standard Electric company, Mr. Glover of the Post-Glover company and Mr. Hemingray of the Hemingray Glass company. These gentlemen had a fine luncheon prepared for their guests, and after it had been disposed of a trolley ride was taken through the city. Later an elaborate dinner was served on the porch of a clubhouse at Chester Park, and several speeches were made.

Mr. Wolff of the Chicago office of the New York Insulated Wire company made a happy speech, congratulating the gentlemen present on the good results of the meeting and predicting great success for them in the future. By special arrangement, the evening trains to Chicago and St. Louis stopped at Chester Park and took the various delegates home. It was agreed by all present that the gathering had been not only profitable but very pleasant.

Among the gentlemen present were the following-named: W. W. Low, Electric Applance company; George S. Searing, Hart & Hegeman Manufacturing company; C. E. Brown, Central Electric company; F. Overbagh, Chicago General Fixture company; A. W. Dee, Dearborn Electric company; L. K. Cushing, Illinois Electric company; James Wolff, New York Insulated Wire company; Mr. Lawrence, Standard Electric company; Samuel Glover, Post-Glover company; Daniel Hemingray, Hemingray Glass company; L. Lilly, Devere Electric company; Mr. Hubbard, Bradford Belting company; F. C. Lanfketter, Commercial Electrical Supply company; R. Stanhope, St. Louis Electrical Supply company; Mr. Sharpe, South Electric company; R. Scudder, Western Electrical Supply company; Joseph Lockwood, Michigan Electric company; L. P. Cody, Grand Rapids (Mich.) Electric company; Mr. Nagle, Nagle Electric company; Mr. Bissell, Bissell, Dodge & Erner; M. B. Austin, Austin & Co.; Charles O. Baker, Anchor Electric company; Charles Jenkins and W. N. Matthews, H. T. Paiste company; E. K. Patton, Perkins Electric Switch Manufacturing company; R. E. Lucas, India Rubber and Insulated Wire company; Mr. Proctor, Proctor-Raymond company.

New York Street Railway Association.

The seventeenth annual convention of the Street Railway association of the state of New York was held at Ithaca on September 12th and 13th. When President G. Tracy Rogers of Binghamton called the meeting to order it was found that delegates from 44 street-railway companies were present, besides nearly 50 representatives of manufacturing concerns and supply dealers. The exercises were opened with the annual address by President Rogers. Other papers were read as follows: "How Can We Increase the Efficiency of Employes?" by F. D. Rounds, general superintendent of the Metropolitan Street Railway company of New York; "Rail Welding," by R. E. Danforth, superintendent of the International Traction company of Buffalo; "Track Bonding," by Alfred Green of Rochester Railway company; "The Paving Question," by T. J. Nicholl, vice-president of the Rochester Railway company; "Transfers, Their Use and Abuse," general discussion; "Railway Power Distribution Over Large Areas," by A. H. Armstrong, assistant engineer, General Electric company; "Some Electric Street-railway Data," by Professor H. J. Ryan, Cornell University; "Experiments on Bonds," by Professor H. H. Norris, Cornell University. Besides the above-mentioned papers, which were thoroughly discussed, a number of interesting topics were brought before the meeting by the members and guests in attendance. The session of Wednesday, September 13th, was held at Sibley College, Cornell University, and after adjournment the different college buildings were inspected, under the guidance of the professors of the different departments.

The customary banquet was held on Tuesday evening and was greatly enjoyed by all those present. DeForest Van Vleet, general counsel of the Ithaca Street Railway company, acted as toastmaster.

A number of pleasant excursions were taken by the visitors to points of historic interest in the vicinity of Ithaca, under the guidance of the officials of the Ithaca Street Railway company.

The following-named gentlemen were elected officers of the association for the ensuing year: President, G. Tracy Rogers, Binghamton; first vice-president, Charles Cleminshaw, Troy; second vice-president, John W. Boyle, Utica; secretary and treasurer, Henry A. Robinson, New York; executive committee, G. Tracy Rogers, Binghamton; Herbert H. Vreeland, New York; Clinton L. Rossiter, Brooklyn; T. J. Nicholl, Rochester; W. Caryl Ely, Buffalo.

At the invitation of the International Traction company it was unanimously agreed to hold the next annual meeting of the association at Buffalo, on the second Tuesday and Wednesday of September, 1900.

The Edison Convention.

Among the papers read at the annual meeting of the Association of Edison Illuminating Companies in Philadelphia last week were these: "Renewal of Lamps," F. W. Willcox, Schenectady; "Relations of Cash and Credit," C. R. Price, New Bedford, Mass.; "Residence Lighting in Detroit," Alex Dow, Detroit; "The Wright Meter in Boston," A. S. Wright, Boston. The report of the lamp-testing bureau was read and discussed, and much attention was devoted to methods of metering, charging and accounting, as usual. In the absence of the president, Mr. R. R. Bowker of New York, Vice-president George R. Stetson of New Bedford presided. New members were elected as follows: Edison Electric company, Altoona, Pa.; Amsterdam Street Railway company, Amsterdam, N. Y.; Edison Electric Illuminating company, Baltimore, Md.; Chester Electric Light and Power company, Chester, Pa.; Jackson Light, Heat and Power company, Jackson, Mich.; Edison Electric Illuminating company, Tamaqua, Pa.

Among those present were the following-named gentlemen: H. A. Wagner, St. Louis, Mo.; Joseph B. McCall, Philadelphia; G. Medici, Milan, Italy; J. T. Maxwell, Philadelphia; A. F. Walker, Grand Rapids, Mich.; E. D. Mullen, Philadelphia; Hoyt Post, Detroit; Gniot Semenza, Milan, Italy; Henry W. Darling, Des Moines, Ia.; J. H. Vail, Philadelphia; H. J. Hartman, Scranton, Pa.; T. E. Crossman, New York city; A. J. DeCamp, Philadelphia; J. M. Eglin, Philadelphia; W. J. Lockhart, Newark, N. J.; W. S. Barstow, Brooklyn, N. Y.; Edwin R. Weeks, Kansas City, Mo.; R. S. Hale, Boston; Louis A. Ferguson, Chicago; H. T. Edgar, Brockton, Mass.; J. W. Lieb, Jr., New York city; A. S. Knight, Boston; W. H. Atkins, Boston; W. H. Johnson, Philadelphia; C. R. Price, New Bedford; J. G. Rossman, Minneapolis, Minn.; J. W. Ellard, Baltimore; Leon H. Scherck, New Orleans; F. M. Noecker, Renova, Pa.; F. P. Spiese, Tamaqua, Pa.; H. C. Fogle, Canton, O.; W. J. Kehl, New Orleans; Fred M. Kimball, Boston; B. E. Sunny, Chicago; Charles T. Hughes, New York; E. H. Mullin, New York; George A. Redman, Rochester; F. W. Willcox, Schenectady; F. E. Barker, Boston; D. L. Huntington, Spokane, Wash.; W. S. Smith, Toledo; Alex Dow, Detroit; Daniel McCoy, Grand Rapids, Mich.; Ch. Wustenfeld, Elgin, Ill.; A. W. Field, Columbus, O.; Charles F. Wallace, Brockton, Mass.; A. M. Robertson, Minneapolis; C. C. Perry, Indianapolis; William Chandler, Sault Ste. Marie, Mich.; C. L. Edgar, Boston; Luther Stieringer, Kansas City, Mo.; A. H. Wanwaring, Philadelphia; John T. Gilchrist, Chicago; F. R. Jenkins, Chicago; E. B. Greene, Altoona, Pa.; George R. Stetson, New Bedford, Mass.; Wilson S. Howell, Newark, N. J.; H. G. Stott, Buffalo; Caryl D. Haskins, Boston; C. P. Steinmetz, Schenectady.

The officers for the ensuing year are: President, J. W. Lieb, Jr., New York; vice-president, William Chandler, Sault Ste. Marie, Mich.; secretary, Wilson S. Howell, Newark, N. J.; treasurer, W. S. Barstow, Brooklyn; executive committee, J. W. Lieb, Jr., New York, chairman; Samuel Insull, Chicago; Alex Dow, Detroit; George R. Stetson, New Bedford, Mass.; W. H. Johnson, Philadelphia; Charles L. Edgar, Boston; William Chandler (ex officio), Sault Ste. Marie, Mich.; W. S. Barstow (ex officio), Brooklyn; Wilson S. Howell (ex officio), Newark, N. J.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:
Suite 510 Marquette Building, CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

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With an automobile exhibition now open in Berlin, another planned for Chicago next month in conjunction with a cycle show, and a third announced to be held in Charleston, S. C., as a part of an electrical exhibition to be given in November, it is evident that the new vehicle is finally accepted by the public, at home and abroad, as an important factor in the world's transportation. Exposition managers claim that there is great difficulty in securing the self-propelled vehicles for show purposes, as the buyers want them for use as fast as the factories can turn them out. The automobile has been many years in reaching its present stage of development, but it has now gained a momentum that promises to send it down the highway of time with a rush.

Negaunee, Mich., is the latest town to discover that municipal electric lighting is not always what its promoters promise. By confusing the accounts of the plant in that town with those of the waterworks an apparent profit to the municipality was shown. But a Chicago engineer was called in to make a thorough examination as a disinterested expert, and he discovered that, so far from showing a profit, the plant was really operated at a loss. Mr. Richardson, the engineer consulted, was entirely dispassionate in the matter and recommended the remedies that his judgment counseled. But the state of affairs illustrates what is so strenuously contended by the commercial-ownership men—that in almost every case the calculation of the costs of municipal lighting is done with such omissions or lack of understanding that a fair statement of the cost of the lighting is not arrived at. Central-station companies, spending their own money and not that of the taxpayers, know exactly what it costs them to furnish light, and they very properly insist that the comparison shall be made on an equitable basis.

In contrast with Sir William Crookes' sensational address of last year, the presidential address of Sir Michael Foster at this year's meeting of the British Association is described as "an academic review of a century of science, conspicuous for its bright literary style rather than originality or deep thought." There will be little difficulty in recalling to mind Sir William's startling plan of producing "electric nitrate" on a tremendously large scale, to avert the "deadly peril of not having enough to eat," by fertilizing the wheat lands of the world. The nitrogen was to come from the atmosphere, and the suggestion was advanced in all seriousness. The idea was not taken seriously, however, either by the author's fellow-scientists or by practical electricians and agriculturists. It was regarded as curious that a man of Sir William Crookes' undoubted scientific attainments should have advocated a plan so far-fetched to remedy a danger so remote. But Sir William, although perhaps disappointed at the reception of his address, stuck to his guns. He considered the future peril of world-starvation a real one and contended that the remedy proposed deserved careful consideration. Only a few weeks ago it was announced that he was preparing a reply to his critics.

While in the United States nothing can be done in the matter of furthering the project of laying a Pacific cable until the assembling of Congress, delay has also arisen over the steps to be taken to secure the laying of the proposed all-British cable from Canada to Australia. The imperial government and the Canadian and Australasian colonies have come to terms and the colonial legislatures are passing the necessary resolutions authorizing their governments to contribute to the cost. New South Wales is the only one that has not, although it is understood there is no trouble about the financial arrangements. Meanwhile the colonial representatives in London appear to have fallen out. On the committee to be named Australasia had been allotted three representatives, Canada taking two seats and the home government three. New Zealand wants one of the three Australasian seats allotted to her, because of her separate contribution and her geographical position. All the other colonies are willing, with the exception of New South Wales, which contests the special claim of New Zealand. In consequence of this the whole matter of the representation has been referred to the colonial governments, and a couple of months has been wasted. In fact, nothing has been done; and unless the colonial governments come to an understanding much quicker than their London representatives seem able to do, the question will have to be hung up for an even more indefinite period, for the agents-general leave at the end of this month for America, to attend the International Commercial Congress at Philadelphia. Great irritation and annoyance exist in colonial circles over this delay. In fact, it may be said that in both the United States and the British Empire the Pacific cable project seems to be curiously fated to excite dissension and to meet unnecessary delay.

The annual meetings of the United States Military Telegraph Corps direct attention to the just and unrequited claims of men who rendered most valuable service to their country during the War of the Rebellion. What the military telegraphers ask is a full and equal footing under the laws of the United States with every other branch of the army that served in the Civil War. They also seek admission to the Grand Army of the Republic. In his annual address at Boston last week Colonel Wilson, the president of the Military Telegraphers' Corps, stated the case thus: "Our society to-day represents one of the greatest achievements of modern times, its members having given to the world a system of army communication in the field in the face of the most stupendous battles since the opening of the Christian era. Those who accomplished this were then modest boys—they are modest men now—but the survivors owe it to themselves, their descendants and the memory of the dead to spare no effort so that full and complete recognition of their services shall be given, not only by the government, but by those who represent the armies which fought in the field during the Rebellion."

Electrical men appreciate the work of the military telegraphers and will join with them in the hope that the long-deferred recognition that is their due may come speedily.

According to all accounts, Russia promises in the next few years to afford a profitable market for the machinery and supplies of American electrical manufacturers. Returning American travelers, United States consuls and the trade journals and bureaus of England and the continent agree that the great country of the Czar is awakening to the opportunities of its vast domain and is determined to take advantage of them and to align itself more closely with the enterprising countries of Western Europe. In this development imported manufactures will be needed for many years, although in time, no doubt, the Russians will be in a position to supply their own needs. Russia is friendly to the United States; it has no reason to be jealous of it, and in years past has shown its regard in a very practical and effective manner. This lack of political suspicion or animosity should help the commercial relations of the two countries, and as the reputation of American goods, especially in machinery and electrical apparatus, is of the best, the outlook is a favorable one, if prices, shipping charges and terms of credit can be arranged satisfactorily.

"In spite of Russia's rapid rise in industries," writes Consul Monaghan of Chemnitz, "it will be a long time before she will be able to supply more than a very small percentage of her vast needs. Even the enormous duties cannot keep foreign goods out of her markets. Mariopol, on the Sea of Azof, is an excellent field in which to sell machines and parts of machines. Here, too, is a good opening for wire ropes, for machine couplers for wire ropes, for shovels, furnace forks, mining machinery, etc. English goods are falling off because they are too dear. Germany, favored by cheap transportation expenses, supplies a large part of the present demand. Enterprising concerns that go early to Mariopol, in the heart of the mining country, are sure to reap a rich reward." The same writer continues: "The opportunity offered in Russia is one of the very best in the world. All we have to do is to adapt ourselves to the requirements of the Russian people—not a very hard task—and a very large share of her foreign trade will fall into our hands. The conditions prevailing in the vast empire could not be more favorable to our manufactures. No nation is so well equipped as we are to supply Russia with the very best weapons with which to work out her industrial and commercial destiny."

In particular there is said to be a notable opportunity for the installation of electric lighting in the port and canals of St. Petersburg, where loading and unloading facilities are seriously curtailed and the shipping trade of the port materially affected by the absence of the electric light. To this and other prospective trade throughout Russia the American electrical man should be fully alive.

Electrical Effects at the Export Exposition.

With appropriate ceremonies the National Export Exposition was opened in Philadelphia on September 14th. In the absence of P. A. B. Widener, president of the exposition, the first vice-president, W. W. Foulkrod, delivered the opening address, turning the exposition over to the governor of Pennsylvania. Director-general W. P. Wilson delivered an address on the "Inception, Purpose, Plan and Scope of the Exposition." "The purpose of this exposition," said Director Wilson, "is to show the foreign consumer what the American manufacturer can make, and how cheaply and how well he can make it." Governor Stone made an address welcoming the visitors, accepting the exposition and turning it over to the mayor of Philadelphia. Mayor Ashbridge accepted the exposition from the governor, and then Congressman W. P. Hepburn of Iowa, chairman of the congressional committee on interstate and foreign commerce, delivered the oration of the day. The benediction was pronounced by Archbishop Ryan, and at its conclusion President McKinley's message, officially opening the exposition, was read.

Although still incomplete, the electrical decorations and displays, both of a useful and ornamental character, will form a very interesting feature of the exposition. At night the interiors of the group of buildings are brilliantly illuminated by a combination of electrical systems, the power for which is furnished partly from the power plant in the exposition grounds and partly from local electrical companies. Within the buildings are 400 arc lamps of various kinds and designs. These, with a large number of incandescent lamps, are supplemented by the electrical displays connected with the numerous exhibits, which, in one or two instances, are of great beauty and brilliancy. The electrical exhibits themselves are in no single instance of great magnitude, but in numbers and variety they are interesting and important. They represent rather those electrical contrivances which are unique and useful and which are of service to the small and local conveniences of life rather than great and extensive operations.

At night the exterior of the buildings will be outlined in an apparent blaze of electric light. The main building will be especially brilliant. Upon its roofs, at regular intervals, are high flagstaffs, from which, during the day, flutter the colors of all nations. The tops of these high poles, instead of being decorated in the usual way by gilded balls, are ornamented by large opalescent globes, and inside of each of these is a 500 candle power incandescent light. The effect of this, showing nearly 200 lights illuminating the flags below, is very striking. About the cornices of the buildings, below the flagstaffs, are strung over 2,000 16 candle power incandescent lamps, making a line of fire which extends entirely around the structures and marking their outlines from a great distance. These electrical effects from above form a fine fringe for the broader illumination below. The outlines of the windows, extending from below the cornices almost to the ground, are indicated by lines of incandescent lamps.

The grounds themselves, about the group of exhibition buildings, have a few electrical effects. The facade of the main building is beautifully illuminated. The arches below the great columns are outlined by 60 incandescent lamps, and the pediment above them, a representation of Commerce, 30 feet long and 10 feet high, is illuminated by more than 100 lamps, bringing out on the darkest night all of the beautiful effects of that ornamentation. High above this is a splendid quadraga 16 feet high, balanced on either side by groups 10 feet high, representing Transportation and Navigation, all of the splendid figures of which are accentuated in bold relief by another arrangement of electric light.

The Grand Esplanade, in front of the entrance, is illuminated by a system of gas lamps in large and beautiful groups, and no electric light appears beyond the line of the cornices of the various buildings which skirt the sidewalk of the Esplanade itself. But the faces of the buildings themselves present a very brilliant effect from the numerous varied and fantastic shapes into which designs have been made by the use of small and many-colored incandescent electric lamps.

The power for all of these electrical illuminations is furnished by local companies and by the Exposition company's own plant, as has been noted. The Powelton Electrical company, a West Philadelphia corporation, furnishes a part at 2,500 volts, and the Callowhill street station of the Pennsylvania Heat, Light and Power company furnishes a portion at 5,000 volts. This outside assistance is supplemented by currents from the power house of the exhibition buildings, in which are three 75-kilowatt, 110-volt and one 100-kilowatt, 220-volt machine. There are also upon the floor of the main building of the exposition one 30-kilowatt, 110-volt machine, driven by a gas engine, and a 50-kilowatt rotary transformer. The general effect of the electrical illumination at the exposition is very fine and has attracted favorable comment. The situation of the buildings themselves is somewhat unfavorable for a fair view from any conspicuous point in the city, but at such points as they can be seen as a whole they present a brilliant appearance.

Municipal Lighting in Negaunee.

Not exactly satisfied with its municipal electric-lighting plant, and to ascertain the exact cost of the service, the City Council of Negaunee, Mich., retained Pierce & Richardson of Chicago to make an examination and report. Mr. R. E. Richardson did the work, and made a report early in the month. He shows that the plant, contrary to the general supposition, had been operated at a loss.

Mr. Richardson begins by showing that there is great difficulty in ascertaining facts in regard to the water and lighting plants (which are operated from the same station), because three sets of books are kept for them. One set is kept for each plant, and in addition there is a set for the city department. Mr. Richardson states (according to the Daily Mining Journal of Marquette, from which this abstract is quoted) that both plants are operated in one building, using the same fuel and supplies. It is difficult to ascertain exactly what part of the fuel and supplies each plant consumes, but it is Mr. Richardson's opinion that the water account has been loaded with charges that properly belong to the electric-lighting account. He reports that in the year 1897 to 1898 the operating expense of the water plant was $4,497.44, with earnings of $7,392.19, giving a balance of $2,894.75 in favor of the plant.

In 1898-1899 the operating expenses for the water plant were $5,884.88, and the income was $6,970.29, giving a balance for the plant of only $1,085.41. Mr. Richardson explains the discrepancy by stating that in the year cited the electrical plant was installed. In 1897-1898 $2,000 was spent on water mains. In 1898-1899 only $648.60 was expended in the betterment of the plant, while the only legitimate increase in expenses was the addition of $10 a month to the salaries of two engineers.

In taking up the electric-lighting plant, Mr. Richardson takes the year from April, 1898, to April, 1899, as a basis for his investigations. The report of the recorder for that period shows that the operating expenses of the plant were $3,919.02, compared with $4,651.15 in receipts, giving a balance of $732.13 in favor of the plant. Mr. Richardson says: "This statement is apparently true as far as moneys paid through orders from the recorder's office and moneys received at the recorder's office are concerned, but it is by no means a statement as to the cost per year of the plant to the city."

The cost of the plant to the city, as shown by the electric-light books, March 15, 1898, is $11,692.82. Mr. Richardson reports that this is not a true statement, as he finds that in September, 1897, $1,000 was transferred from the city fund to the electric-lighting fund. This procedure was repeated in December, 1898, when $2,000 was transferred. In addition, bills from Engineer McRae on account of the lighting fund, which amounted to $662.75, were charged to the city-tax fund. The total of these amounts, $3,662.75, must be added to the cost of the plant, which makes it $15,355.58 to date of April, 1898.

From 1898 to 1899, $836.44 was charged to construction. Fifty per cent. of that amount should have been charged to running expenses. Deducting this amount from $4,757.96, the total expense of the plant for the year, April, 1898, to April, 1899, the running expenses were $4,339.74. Allowing ten per cent. for depreciation on the investment of $15,773.80, $1,577.38 has to be added to running expenses for the year, making a total of $5,917.12. This statement gives a deficit of $1,265.97, instead of an earning. Mr. Richardson shows that when other expenses, such as the increased cost of coal, are considered, the city is paying $114.49 a year for every arc light in use.

The author of the report estimates that up to April, 1899, the plant cost the city $23,198.96. In the same period the receipts were $6,524.43. He then takes up the question of rates and unsparingly denounces the system of flat rates now in use. He states that the city will never be able to put the plant on a paying basis unless meters are used, with a sliding sale of discounts.

Mr. Richardson outlines a scheme of bookkeeping which would keep the accounts of the two plants distinct, and which should be adopted if the taxpayers are going to know anything of what each plant is doing. Only by changing the present system can the affairs of the plants be put on a business basis. Mr. Richardson's summary of his report is as follows:

A. That the electric-light plant ran behind $1,265.97, instead of making $732.13, as shown by the report of April, 1899, for the fiscal year.

B. That a very considerable amount charged to operating expense of the water plant was expense which should have been charged to the electric-light plant.

C. That the city plant can never be put on a paying basis until it raises its rates and increases its output.

D. That the actual cost per year for operating individual plants cannot be known until meters are put in and records kept.

E. That the cost of operating each arc lamp for the last fiscal year was $106.49, as figured from the present records.

F. That the method of charging for lamps on a flat basis is wrong from a commercial or business standpoint, unless rates are put so high as to protect the station, which would make it very expensive for the customer who does not waste his lights or use them to any great extent.

Dynamo and Motor Men Discuss Business Relations.

At the invitation of Messrs. H. H. Cutler and J. G. Hickcox, respectively general manager and secretary of the Cutler-Hammer Manufacturing company of Chicago, a meeting of representatives of the dynamo and motor manufacturers of the country was held at the Grand Pacific Hotel, Chicago, on the evening of September 19th. The gentlemen present were entertained at dinner by the Cutler-Hammer Manufacturing company, and afterward adjourned to another room, where business matters of general interest were discussed. Mr. Campbell Scott of the C. & C. company presided and Mr. C. C. Warren of Sandusky, O., acted as secretary. The discussion was very general in relation to the recent advance in the price of raw material and other matters of interest to the trade. The list of those present, with the companies they represented, is as follows:

Company.	Town.	Represented by
C. & C. company	New York	Campbell Scott.
Warren Electric Manufacturing company	Sandusky, O.	C. C. Warren.
Jas. Clark, Jr., & Co.	Louisville, Ky.	Jas. Clark.
E. G. Bernard & Co.	Troy, N. Y.	E. G. Bernard.
Keystone Electric company	Erie, Pa.	J. W. Leech.
Akron Electric company	Akron, O.	S. A. Sague.
Belknap Motor company	Portland, Me.	W. Pimlott.
Commercial Electric company	Indianapolis, Ind.	S. L. Hadley
Crocker-Wheeler company	New York	C. H. Wilmerding
Eddy Electric Manufacturing company	Windsor, Conn.	M. E. Baird.
Elwell-Parker Electric company	Cleveland, O.	F. C. Phillips.
Ft. Wayne Electric company	Ft. Wayne	F. S. Hunting.
Holtzer-Cabot Electric company	Brookline, Mass.	E. R. Harding.
Milwaukee Electric company	Milwaukee	Walter Cary.
Northern Electric Manufacturing company	Madison, Wis.	A. O. Fox.
Siemens & Halske	Chicago.	C. S. Knight.
Triumph Electric company	Cincinnati, O.	J. C. Hobart.
Quaker City Electric company	Philadelphia	W. S. Jones.
Wagner Electric Manufacturing company	St. Louis	E. F. Abadie.
Roth Bros.	Chicago	Roth Bros.
Western Electric company	Chicago.	C. B. Waite.
Sprague Electric company	New York	E. B. Kittle.

In addition, the following-named companies were invited to send representatives, but did not do so: Thresher Electric company, Dayton, O.; Westinghouse Electric and Manufacturing company, Pittsburg; New England Motor company, Lowell, Mass.; Eagle Electric Works, Peoria, Ill.; Jenney Electric company, Indianapolis; Connecticut Motor and Dynamo company, New York.

On September 20th another meeting, at which the General Electric company was represented, was held. It is said that no definite plan was adopted, but a committee was appointed to call a future meeting.

New Form of Storage Battery Grid.

An iron grid for storage batteries that is especially adaptable for use on automobiles has recently been invented by Mr. J. J. O'Connell, a Chicago telephone engineer. The grid consists of a cast or wrought-steel plate, treated with a lead coating, to prevent the acid from attacking the iron. In the construction of the grid a one-eighth-inch steel plate is placed between two one-sixteenth-inch sheet-lead plates, and the three plates are then punched full of three-fourths-inch holes, spaced so as to leave enough stock for strength. Lead bushings are inserted in the holes and flanged over at the ends, so as not to leave the steel exposed. The whole grid is then tinned, in order to prevent electrolytic action between the iron and lead. Active material is put into the receptacles of the grid in the regular way. This combination gives a grid that is especially suitable for automobile work, as the plates are not as heavy as those made out of lead or compositions, and, moreover, are stronger and, it is claimed, will not buckle. The inventor says that his plate will last as long as any other plate on the market and is not expensive to manufacture. The thickness of the plate is, of course, arbitrary, but the same relation holds between the steel and lead, viz., the thickness of each lead plate being one-half that of the steel.

Interesting Valuation Figures.

Some of the revised valuations of personal property made by the Board of Review of Chicago are as follows: Chicago Telephone company, $3,823,000; Chicago Edison company, $2,500,000; Commonwealth Electric company, $320,000; Chicago Sectional Electric Underground company, $125,000; Osburn Electric Manufacturing company, $4,000; Crocker-Wheeler Electric company (in Chicago), $5,000; Cosmopolitan Electric company, $30,000; C. E. Gregory company, $40,000; Western Electric company, $2,000,000; Electric Appliance company, $40,000; McIntosh Battery and Optical company, $10,000; General Electric company (in Chicago), $89,600; Central Electric company, $75,000; Morgan-Gardner Electric company, $40,000; Cutler-Hammer Manufacturing company, $15,000.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Douglas County Telephone company of Superior, Wis., recently had several trunk lines struck by lightning, which burned out a large number of instruments. Repairs were made at once.

The Fargo (N. D.) telephone exchange has over 700 instruments in use. This is said to be the greatest number in proportion to population of any town in the country.

The Baraboo (Wis.) Telephone company has completed connections with Sauk City and Prairie du Sac, where it connects with the Troy-Honey Creek company for points between Prairie du Sac and Spring Green.

The Crookston (Minn.) telephone exchange has nearly 200 instruments in use.

A new telephone switchboard has been installed at St. James, Minn.

The new Hutchinson (Minn.) Telephone company expects to make an addition to its switchboard soon. It has nearly 100 instruments connected.

The People's Telephone company of Superior, Wis., announces it has made arrangements for connections with Minneapolis.

The council of Appleton, Wis., has granted a franchise for a local telephone exchange to Messrs. Ferdinand and Crosswell and for a toll and local system to the Chicago and Lake Superior Telephone company.

The new telephone exchange at Edgerton, Wis., is about ready for operation.

The Southern Minnesota Telephone company is about to install a local telephone exchange at Redwood Falls, Minn.

The Greene and Weston Telephone company has nearly reached Shakopee, Minn., with its wires on the way to Minneapolis.

Dennis Ward is about to install a telephone exchange in Zumbrota, Minn.

An effort will be made to establish a local telephone exchange at Olivia, Minn.

The Zenith Telephone company of Duluth, Minn., will put in a temporary submarine telephone cable between Duluth and West Superior, for the benefit of the grain interest. The company was disappointed in the delivery of the regular cable.

The Northwestern Telephone Exchange company in Minneapolis has discontinued diplomatic relations with the Druggists' association. The latter held a meeting and invited the company to have a representative present. Instead of a representative, there was a letter from General Manager Wainman, stating that he felt he had been treated discourteously by the association and had been misrepresented. He therefore declined to have any further dealings with the association.

A local telephone exchange will soon be in order at Appleton, Minn.

The Western Electric Telephone company is pushing work on a line from Chamberlain, S. D., to Heron Lake, Minn.

The Mississippi Valley Telephone company claims to have 4,800 subscribers in Minneapolis, and expects to have instruments connected for all by January 1st. The company's franchise requires that it have 1,200 connections by October 25th, but it expects to have that many in operation a month prior to that date.

The Winona (Minn.) Telephone company has secured new quarters for its central office.

The Duluth Telephone company expects to have toll-line connection with Ashland, Wis., from Duluth, Minn., by October 1st.

The Dakota Central Telephone company will extend its wires from Sisseton, S. D., to Bossko and Veblen.

There is a proposition on foot to run a telephone line from Sogn, Minn., to Kenyon.

The Wisconsin Telephone company, which was stopped from extending its system in Sheboygan, Wis., without a franchise there, has now applied to the council for that permission.

The Mississippi Valley Telephone company is about to apply for a toll-line franchise in Duluth, Minn., and proposes a line from the Twin Cities.

The Northwestern Telephone Exchange company has put in a metallic line between Albert Lea and Alden, Minn.

H. O. Larson of Chicago has taken charge of the telephone exchange at Manchester, Ia.

The Mutual Telephone company of Des Moines, Ia., has been sued by Mrs. Mary C. Roche, as administratrix for the estate of John I. McDonald, asking $10,000 damages for the death of Mr. McDonald, alleged to have been caused by a shock received from a fallen wire of the company.

The Home Telephone company of Oskaloosa, Ia., has nearly 500 subscribers, and is about to put in a new cable and other improvements at a cost of $3,000

The Iowa Telephone company is building a line from Clinton to DeWitt, Ia.

Sanborn, Ia., votes October 2d on granting a franchise for a telephone exchange.

Missouri and Kansas Company Doubles Its Stock.

The Missouri and Kansas Telephone company (Bell) has doubled its capital stock, the amount being now $2,500,000. New bonds to the amount of $1,250,000 will also be issued. The company expects to extend its toll-line service and bury its wires in Kansas City with the additional capital.

The Topeka State Journal gives a lively account of the company's operations. "John R. Mulvane, who is president of the company," it says, "went down to Kansas City yesterday [September 12th] to attend what was said to be a special meeting of the stockholders of the company. As a matter of fact, the meeting was attended by Mr. Mulvane, General Attorney Frank F. Rozzelle and six other directors. Each director had with him a large number of 'proxies' of other stockholders, so that there was 97 per cent. of the stock of the company represented at the meeting.

"It was all very simple, as the plan had been agreed upon beforehand, and the action of the eight directors was only a formal matter. Mr. Mulvane did the presiding, Mr. Rozzelle did the steering, and the other six did the voting.

"It is claimed that none of the additional capital stock will be offered for sale at present. About half of the authorized issue of $1,250,000 of bonds will be issued in the immediate future. The company has put up about 1,000 miles of poles and 5,000 miles of wire during the past year, and in the next year or so it will extend its lines down through the Indian Territory.

"It is said that the Missouri and Kansas Telephone company began business 20 years ago with a cash outlay of $15,000. That was when telephone apparatus was high. Its present capital stock of $2,500,000 represents the profits of the company during that time and the water that has been put into it. Appearances would indicate that it had got along fairly well to have made this increase in addition to the dividends that have been declared. That there is money in the telephone business is proven by the fact of the great number of exchanges which have been established by Independent companies in Kansas within the past two or three years."

Government Telephone Extensions in England.

In his recent annual report the postmaster-general of England states that the reduction in the charges for postoffice telephone-exchange wires and for short lines of private wire, which was made in October, 1897, has continued to lead to an increased demand for these facilities, the revenue for the year from this source being £142,600, against £130,100 in the previous year. The number of postoffices open for trunk-telephone business on March 31st last was 286, an increase of 22 in the year. Out of the sum of £2,300,000 authorized by Parliament for the purchase and development of the trunk system, the expenditure up to March 31, 1899, may be put down approximately at £1,354,241. The expenditure during the year was £153,237. During the year the trunk system was extended to *Bradford (Wilts), *Buckie, *Cirencester, *Coldstream, Cowbridge, *Dunoon, *Hereford, *Huntingdon, *Market Harborough, *Nairn, *Newmarket, *North Berwick, Penzance, *Peterborough, *Rothesay, St. Austell, *Salisbury, *Stamford, Truro, Waterford, Wexford, *Weybridge. In the case of the towns marked with an asterisk the extension has been carried out under guarantee from the National Telephone company. The total number of trunk-wire transactions during the year was 7,066,069, or, reckoning each transaction as involving at least two spoken messages, a total number of 14,132,138 messages (an increase of 19.7 per cent. over the preceding year). The revenue was £167,505 (an increase of 25 per cent.), and the average value of each transaction was 5.68d., as against 5.45d. for the previous year. Postoffice telephone exchanges were opened during the year at Cowbridge, Ferndale, Forth, Tonyrefail and Treherbert, each exchange being placed in connection with the trunk system.

Telephones in France.

All telephone as well as telegraph lines in France are owned and operated by the government. There are 112 towns outside of Paris supplied with telephones, with an aggregate population of 6,000,000, and yet only 18,000 subscribers, one for each 300 inhabitants. More than one-half the subscribers in the entire country are in Paris, or 9,600—one telephone for each 253 citizens. Switzerland, with one-tenth the population of France, has 225 suburban stations, with 20,500 subscribers. In France the subscriber must bear the expense of putting in the line, about three cents a yard, and then buy the entire outfit, at a cost of about $25. He pays in Marseilles an annual rental of $40. At present it is proposed to put in metallic circuits and require the subscriber to meet this expense. As might be expected, there is much complaint in France, both of the expense and the unsatisfactory operation of the system.

Long-distance telephone connection between Chicago and Dallas, Tex., has been made.

GENERAL TELEPHONE NEWS.

Attorney C. J. Spellman of Kansas City is suing the Missouri and Kansas Telephone company for $2,000. He demanded that it should furnish him with telephone service at $36 a year, according to an old ordinance, and the company refused.

It is said that the Mutual Telephone company, which has been doing business in Logansport, Ind., for several years, is about to abandon the field. Inadequate support is assigned as a reason for quitting, the low rate established at the inception of the undertaking having proved to be insufficient to maintain the service.

The total assessment of the telegraph and telephone companies of the state of Iowa as agreed upon by the Iowa Executive Council aggregates $1,208,836. Of this amount $221,565 is the assessable valuation of the Iowa Telephone company, with headquarters in Davenport; $16,150 that of the American Telegraph and Telephone company of New York.

The time allowed the Cumberland Telephone company by the City Council of Paris, Tenn., to remove its property in that place has expired. The council met on July 14th and repealed an act granting the telephone company a franchise upon the ground that it charged too much, and giving it until August 14th to remove its property, but the company has shown no disposition to comply, and is extending its business wherever it can, and assures the people of Paris that it is there to stay. If both council and company remain firm the chances are good for a costly and protracted litigation.

Fair promises by the Bell people are not confined to the East or Middle West. Thus, the Rocky Mountain Bell Telephone company says that the new building in Boise, Idaho, is contracted to be finished by October 15th. The company will then, it says, inaugurate the proposed improvments in the Boise service with a reduction of rates. New instruments will be put in for subscribers and all instruments used in the exchange will be of the long-distance style, both business and residence. It is promised that the latest improved apparatus known to the telephone business is to be used in this system throughout.

The Chicago Telephone company appears to be making an extra effort to extend its out-of-town business by making low rates, and appears to have succeeded in enlisting the farmers as construction hands. The Elgin News states that the company is making arrangements to extend its Plainfield service out among the farmers, and already 50 of the farmers south of that place have subscribed. The rental for the farmers, on a six-party line, is $12 a year. In addition to this, the farmers haul the poles out on the line and set them, haul the wire, and the telephone company's men come and string the wire and place the instruments.

Long-distance Service of the Bell Company.

The American Telephone and Telegraph company has completed its lines into St. Paul. This practically completes the long-distance telephone connections to northwestern cities, and connection may be had as far west as Grand Forks and Jamestown, N. D. The company has also completed its lines from Memphis to Little Rock, and communication may now be had with that point, and through the completion of this line with many of the principal towns and cities in Texas and Arkansas. The company has completed its line from Huntsville to Montgomery, Ala., and it is now constructing a line from Montgomery to New Orleans, which will be extended westward to Houston, Tex., where connection will be made with Galveston.

This company, according to the Chicago Tribune, has expended more than $3,000,000 during the present year in extensions which connect its main lines with many of the smaller towns and villages through the country east of the Mississippi River. Other work is under way or in contemplation which will practically gridiron the South, and which will make it possible for people in Chicago to get into telephonic communication with cities in the southern states as well as they now can with the eastern and New England states. The recent increase in capital stock of the company was made necessary by the extensions to the present line and the building of new lines in the territory in which it operates. Officers of the company say there is no probability of any combination between it and the many rival concerns which are springing up throughout the country. They affect to believe that it would take years for any new concern to occupy the field and to take away any appreciable amount of its business.

C. R. McDowell of Louisville and B. T. Woods of Perryville have incorporated the Boyle Citizens' Telephone company, to operate in Boyle and adjacent counties in Kentucky. The capital stock is $2,200.

Power of City to Regulate Location of Telephone Poles.

In the case of the city of Marshfield, Wis., against Telephone company, the Supreme Court of Wisconsin says that the city does not own and cannot alien its streets. It cannot rightfully authorize obstructions therein without legislative authority. Its duties and obligations with respect thereto are defined in its charter.

The general law, the court goes on to say, grants powers and privileges to persons or corporations like the defendant company, to be exercised by municipal consent or subject to municipal limitations. Section 1778 of the Revised Statutes of the state, of 1898, as heretofore interpreted, authorizes the use of the highways of the state by such corporations, by their poles and wires, provided they are so set as not to obstruct or incommode the public use thereof. But this section, it was conceded, does not deprive cities of their power of police control over the manner in which such work shall be done, and they may adopt, by ordinance, all reasonable regulations for the location and use of telephone poles and wires in the streets.

In the exercise of this power not only may municipal corporations make all reasonable regulations for the location and use of electric wires in the streets and require all reasonable safeguards for the same, but, the Supreme Court now holds, the city authorities may go so far as to prohibit the encumbering by telephone poles of certain streets, in the exercise of a reasonable discretion. Such right, it thinks, necessarily follows, from the grant of the power to regulate. And it maintains that it is also implied from the fact that the dominant purpose of a street is for public passage, and that any appropriation of it by a legislative sanction to other objects must be deemed to be in subordination to this use, unless a contrary intent is clearly expressed.

Moreover, a provision in a city's charter that no obstruction shall be placed in its streets without a written permit by the Board of Public Works, which shall have the power to determine the time and manner of using the streets for placing and maintaining electric lights, telegraph and telephone poles, subject to appeal to the Common Council, the court holds, gives to the board ample power to exercise control over the streets of the city, subject to appeal to the council. Whether it gives the board power to totally prohibit the encumbering of the streets of the city by telephone poles, it does not deem it necessary to decide in this case.

The fact that the Common Council had adopted no ordinances, or the Board of Public Works had passed no regulations, in relation to pole setting, the court declares, afforded no justification for a threat to go ahead setting poles. It says that before the board could act intelligently, it was necessary for it to know something about the desires and intentions of persons desiring to use the streets. When the situation had sufficiently developed so that the board could act understandingly, it would become its duty so act, and to act reasonably. It was likewise incumbent upon the telephone company to make its purposes and wishes known to the board, and to give the board a reasonable time to take action. The company, it holds, had no right to enter upon the streets of the city, even though no prohibitory ordinance had been passed, and occupy them as it pleased, and set up poles that were obstructions at will. Its right to go upon the streets with its structures was limited by the charter provisions mentioned, and until it had complied with the requirements, the court insists, it was without legal justification.

In other words, the court holds that before the company could occupy any of the streets, application should be made to the Board of Public Works and a reasonable time given for that body to act. And it is of the opinion that the board would have an undoubted right, in the exercise of a reasonable discretion, to prohibit the encumbering of the main business street of a city with wires and poles.

The discretion of the Board of Public Works, the court adds, can be controlled by the council on appeal, though it is not within the power of the council to determine the time when or the manner in which a telephone company may set up its line, except in the exercise of its appellate jurisdiction over the board.

In the exercise of its powers, the council may consider that the rights of the company, under the general law, are in subordination to the police powers vested in the city authorities, and may adopt all reasonable regulations necessary to prevent its streets from being obstructed or encumbered. If it acts contrary to the law, no doubt, the court says, an ample remedy exists.

Kansas Notes.

The Sabetha Telephone company is building a line to a large number of farmers in the country around Sabetha.

The Concordia Telephone company has gained about 75 subscribers since it changed its plant from the automatic to a manual system, and it is still on the increase. It is now building toll lines to the neighboring towns.

The Telephone Conflict.

A correspondent of the New York Tribune at Indianapolis gives a rather interesting sketch of the telephone development of the Independents. He claims that the Indiana city is the center of the movement and states that the history of the Independent telephone movement began five years ago at Fort Smith, Ark., according to the best information of men interested in the telephone business. "The second Independent telephone company," he adds, "is claimed by Lafayette, Ind. In the last three years the upspringing of Independent telephone companies has been rapid and widespread, particularly in Indiana, Illinois and Ohio. Independent exchanges have been established in much smaller towns than the Bell company has entered, and the reason is that the Independent companies are formed by home capital, and have the encouragement of almost every inhabitant of every town. The Bell company has not been inactive during the growth of the Independent telephone system, and it has been energetically extending its lines to compete with the Independent companies. The Independent companies have reduced telephone rates and the Bell company has met the reductions. The struggle between the old Bell company and the new Independent companies is fierce. All sorts of charges are being made on both sides in an effort to gain the sympathy of the people. It is natural that the people should sympathize with industries originated in the home town or city, and the Independent companies have had that advantage, but the Bell company has the equally great advantage of having been established for years. Independent telephone men do not expect that they will be able to 'run the Bell out of the business.' They believe that when the Independent system extends from New York to San Francisco and from Canada to the Gulf, as does the Bell system, telephone conditions will balance themselves, and the two great systems will settle down and work for business with the equanimity of the two telegraph companies. That time is some years away, however, and now a fight is necessary. The Independent companies assert that the Bell company is giving telephone service free in many towns for the purpose of holding its patronage, and that it has cut rates far below the Independent prices. This is denied by the Bell company, and it, in its turn, shows an inclination to say sarcastic things about the 'young person' and its attempts to become a real competitor of the old and established Bell company."

Long-distance Lines in Arizona.

It is the intention of the Sunset Telephone company to commence work immediately on a long-distance telephone line in Arizona, which will connect Tucson, Phœnix, Prescott and Jerome and a number of towns en route. Work will be begun at three separate construction camps. One party will work north from Phœnix and one east from Mesa and Florence. The third will commence operations at Tucson and work north to meet the line started east from Phœnix. It is estimated that the line will be built between Tucson and Prescott by January 1st. When it is completed it will be extended south to Naco, near the Mexican line, and perhaps farther. Another line ultimately will be extended to Globe. Those who have the matter in charge say that it will not be long before the line is extended from Jerome at the northern terminus into California.

PERSONAL.

Mr. W. H. Adkins, manager for the Southern Bell Telephone company at Augusta, Ga., has been promoted to be special agent, with headquarters in Atlanta.

President P. C. Burns of the American Electric Telephone company of Chicago visited New York last week. Mr. Burns has recently greatly increased his factory facilities and is a very busy man; but he needed rest and allowed himself a vacation of a week or so. Mr. Burns made a trip into Canada and came down through Boston, New York and Philadelphia.

General Manager Henry Shafer of the Stromberg-Carlson Telephone Manufacturing company of Chicago has been on an extended trip throughout the East. Mr. Shafer was partly on business and partly on pleasure bent. He seized the opportunity while in the East of enjoying the Phillips clambake at Providence, and also spent some time in Boston, thence dropping down to have a glimpse of Newport. He appeared in New York on Wednesday of last week and afterward went West, stopping at a number of points. As is now pretty generally known, Mr. Shafer was not long ago formally appointed to the general managership of the Stromberg-Carlson company. For a year or so he had practically held this position and his formal appointment was simply a public confirmation of the appreciation of his services and the confidence in which he is held by Messrs. Stromberg and Carlson. The company was never in a more prosperous condition than at the present time, and this state of affairs is largely due to the harmony in executive matters that has always existed between Messrs. Stromberg, Carlson and Shafer.

Vandalism in Indianapolis.

Twice during the last month, according to a local paper, someone has entered the plant of the New Telephone company in Indianapolis with the evident intention of damaging the lines or building, and last week linemen found in the alley east of Alabama, and between Sixteenth and Seventeenth streets, the cause of trouble which they had tried for a week to locate. Someone, thought to be connected with those who have forced entrance to the company's building, had evidently shot holes in the lead cables, thus destroying the service of telephones on that circuit. Two sections of the cable were taken to the police station. The holes had every appearance of having been made with a rifle or large-caliber revolver. Mr. Gates and the detectives put on the case say they have as yet no clew to the persons doing the work.

What is believed to be another attempt at destruction of the company's property was a fire that was started in an open space between two of its buildings. The space is filled with barrels containing pipe and others filled with shavings, excelsior and other light materials. The fire was discovered by Frederick Ernst, the night watchman, while making his rounds, and the alarm turned in from the exchange. Before the fire department arrived, however, members of the Marion Club had the flames under control. So well did they do their work that the services of the fire department were not needed. The damage was but slight, but it led to an announcement by Harry B. Gates, secretary of the company, that $500 reward would be paid for information leading to the arrest and conviction of the person or persons harassing it.

Absolution by Telephone.

[From the Chicago Tribune.]

A curious instance of the modern tendency of the Roman Catholic Church to keep abreast of the age may be found in a theological treatise just published in London, entitled "The Sacraments Explained According to the Teaching and Doctrine of the Catholic Church." The author is the Rev. Arthur Devine, Passionist, a recognized authority on orthodox Catholic theology. He says it has not yet been officially decided by the pope whether or not confession can be heard and absolution given by telephone, but he is inclined to believe such action would be valid under certain circumstances. It is one of the requirements of valid confession and absolution that there should be "a moral presence of the penitent with the confessor." A written confession sent to an absent priest is not valid, but Father Devine says that "a priest might give absolution by telephone, under condition, to a person taken suddenly ill, so as to be in imminent danger of death, and when he cannot possibly reach the place where the person is," in which case "the penitent and confessor may be truly said to be conversing together, and consequently to be morally present to each other." The idea of grafting a venerable rite upon the most modern of inventions will have a curious interest for Protestants as well as for Catholics.

EXTENSIONS AND IMPROVEMENTS.

The Inland Telephone company will install a new plant at Lewiston, Idaho.

A sufficient number of subscribers has been secured for telephones to insure a local line to Astoria, Ore., from Warrenton. The line will be built as soon as possible.

The Oregon Telephone company will soon have its line completed between Myrtle Point and Roseburg. For the entire distance between Bandon and Myrtle Point the line will be rebuilt.

The Independent telephone line between Syracuse and Nebraska City, Neb., is completed and ready for operation. The Telephone Exchange and Construction company is the proprietor.

The Butte County Electric Light and Power company proposes to put in active operation a complete telephone system to compete with the Sunset Telephone company in the territory reached by its lines from Redding to Sacramento, Cal.

President G. Y. Wallace of the Rocky Mountain Bell Telephone company is back in Salt Lake from a trip to Montana. He says that the work on the Idaho Falls-Butte line is retarded by the slowness in setting the poles. It will probably be a month before the line is completed, but when the connection is made a man in Salt Lake can talk to a person in Portland or any of the coast cities.

MANUFACTURERS AND DEALERS.

The Eastern Electrical Construction company has secured the contract for erecting the plant of the Montour and Columbia (Pa.) Telephone company.

The Texas Arm and Pin company of Beaumont, Tex., manufactures long-leaf yellow-pine cross-arms, space blocks, oak and hardwood lumber pins and brackets. A specialty is made of the Dewey arm. The company claims to be the largest manufacturer of these goods in the South, the factories of the firm having a capacity of 10,000 arms a day.

General Electric Subway Transformers.

Owing to the great extension of underground line conductors in cities it has become necessary to employ transformers, not only weatherproof but waterproof. The General Electric company claims to have been the first to attack the problem of manufacturing a transformer that would not be damaged by water, even though completely submerged, as sometimes occurs in a manhole. A complete line of "watertight" or "subway" transformers of sizes from five kilowatts to 30 kilowatts inclusive was developed. This apparatus is said to have the high efficiency and superior qualities of the company's well-known type H transformer.

As an indication of the favor with which this particular production of the General Electric company is viewed, mention is made of a contract which the company recently closed with a large lighting company. Having decided to replace 24,000 lights' capacity of pole transformers, this company contracted with the General Electric company to supply the necessary capacity of subway transformers of sizes from 10 to 30 kilowatts.

The transformers are of the standard type H construction, with exception of the case, which is oval in horizontal section, with lifting lugs on the sides, so arranged that they will not interfere with the sides of manholes when being placed in position.

The arrangement for carrying the cables into the

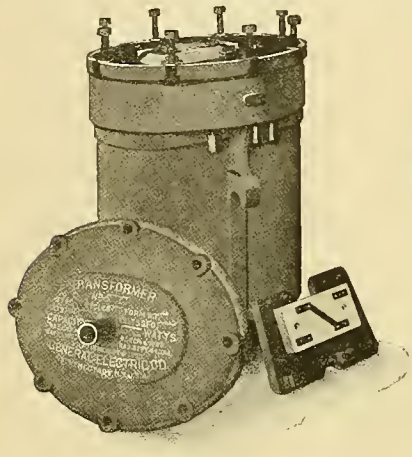


Fig. 1.

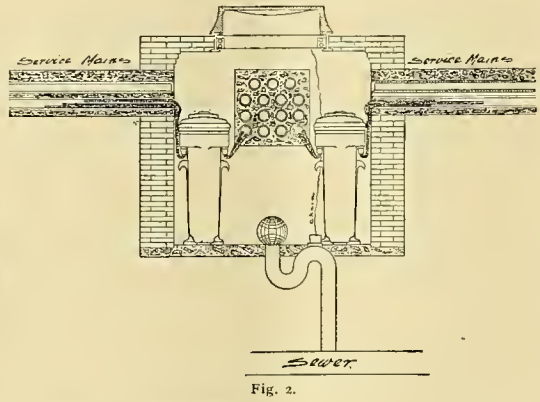


Fig. 2.

GENERAL ELECTRIC SUBWAY TRANSFORMERS.

case is an interesting feature of the transformer. The lead-covered cable is passed through a metal bushing, and a plumber's wiped joint made, after which the bushing is drawn tight against a faced seat by a nut on the inside of the transformer, a special wrench being furnished for this operation. The cover is held in place by a number of bolts, the surfaces of box and cover are machined, and a specially prepared elastic packing is used to exclude all moisture.

Referring to the illustrations, Fig. 1 shows a 10-kilowatt subway transformer, with cover removed; Fig. 2 is a diagram of two 30-kilowatt transformers, as located in a manhole.

The number of bolts for clamping down the cover indicates that the point of an absolutely watertight joint has been most carefully considered. In the cover is shown a short pipe, to which is attached another pipe long enough to reach above the high-water mark of the manhole. This serves as a vent to allow expansion of the oil from heat and also to prevent explosion in case of the formation of dangerous gases inside the transformer.

Westinghouse-Walker Affairs.

A dispatch to the Chicago Inter Ocean from Cleveland, O., under date of September 15th, reads as follows:

A bill of complaint was entered in the United States Circuit Court to-day by the Standard Trust company of New York against the Walker company. It sets forth that the latter company on December 20, 1898, issued $1,175,000 worth of "second-mortgage 5 per cent., 30-year gold bonds, with interest due semi-annually from July 1, 1898, and secured by a mortgage on the company's property in Cleveland and New Haven." It is stated that on January 1, 1899, there became due on the bonds $29,375 interest, and it is alleged that the interest has not been paid.

The petitioner expresses the belief that the company is insolvent and unable to pay its debts, and the court is requested to appoint a receiver or receivers with power to carry on the business under the court's control. It is also requested that the mortgage may be adjudged a lien on the property, and that, if necessary, a foreclosure may be made and a sale of the property ordered.

As was stated in the issues of the Western Electrician under dates of September 24 and October 1, 1898, the Walker company was virtually consolidated with the Westinghouse Electric and Manufacturing company last September. The Walker company still retained its corporate identity, however, and it is said that this action has been taken to wind up the affairs and business of the old Walker company in order that the plant may be operated under full control of the Westinghouse company.

Electric Fog Horn.

One of the latest applications of electricity to marine devices is the electric foghorn. So long as men go down to the sea in ships, their greatest peril will be in the fog-hidden coast. Sound is the only known method of warning mariners under such circumstances, and many are the noisy devices in use for that purpose. The great drawback to the general use of steam fog-whistles is their cost. It is not surprising, therefore, that the marine authorities of the United States and Canada have been watching the development of cheap motive power with a keen interest. The practical utilization of the naphtha motor in this connection is said to be due to the inventive genius of Mr. Trudeau, an electrical engineer of Ottawa, Ont. In his workshop he has already in working order an electric fog-alarm, which will, in all probability, be the model generally adopted in the United States, as well as in Canada. The mechanism has been patented in Canada, but as the American patent is yet in abeyance, a general description only is available. A naphtha engine supplies the motive power to a dynamo that furnishes the electric current, by means of which three pairs of electromagnets operate half a dozen clappers that strike against a large gong with a frequency of about 36,000 strokes a minute, producing an almost continuous sound. Its effectiveness is enhanced by a mechanism somewhat on the principle of a megaphone, by means of which the sound is not only intensified, but thrown in the required direction. A model of the Trudeau electric fog-alarm was not long ago tested at Ottawa, and although it was comparatively a tiny affair, its sound was easily heard a distance of two miles. The sound of the completed machine will be easily distinguishable at a distance of 15 miles. It is intended to forward the machine to the British Columbia coast, where it will be installed and put in operation at once.

Barron Bridle-ring Insulators.

Bridle-ring insulators, designed for carrying groups of insulated wires to and along the walls of buildings and distributing them to subscribers' offices, are being placed on the market by the manufacturers, James S. Barron & Co., 24-30 Hudson street, New York. These insulators are made of the best quality of drop-forged iron and are heavily enameled. The cut represents the ring approximately half size. It is claimed that new wires can be inserted and old wires removed readily from these insulators and without injury. The rings can be screwed into the most difficult places with the hand, and when desired can be unscrewed and used again for other work. Being strongly made, the manufacturers claim that they will last indefinitely. A small-sized enamel insulated screw-eye is also manufactured by James S. Barron & Co., which has a five-eighths-inch eye, but no opening at the top.

Why American Apparatus is Preferred.

[From the London Electrical Review.]

A statement has been made elsewhere that the Japanese prefer American to British electrical apparatus. The reason given is that Americans execute their orders more promptly than do European firms, and also that the goods supplied are found superior. If there is any justification for the latter statement, it is quite time the matter was investigated more closely, so far as it concerns English manufacturers, for if we fail to retain our reputation gained of old for superiority, it will be a poor lookout for our future trade abroad.

Water-power Electrical Plants in the United States.[1]

By B. C. Washington, Jr.

For many centuries man has patiently and earnestly sought to control the vast powers of nature, so that they shall do his bidding. Human genius has triumphed, and now on the eve of the twentieth century an enlightened world gazes in wonder and admiration while Americans harness the power of their greatest rivers, convert this power into electricity and transmit it with commercial success to distant mining or manufacturing centers.

The application of water as a power for driving mechanical devices is supposed to have been attempted in Rome, about the time of Augustus, 63 B. C. to A. D. 14. During the succeeding centuries various machines have been originated for the utilization of water power, and recent years have witnessed a most rapid and wonderful progress in their development. The old power-wasting water-wheels of various types have been superseded by turbines for ordinary heads of water and wheels of the Pelton and impulse types for extraordinary heads.

The first transmission of electrical power for industrial purposes was accomplished in 1878, at Sermaize, a short distance from Paris, France. The dynamos in this instance were driven by steam engines. Shortly after this demonstration of the practicability of the transmission of electricity followed the application of water-wheels for driving dynamos.

In the United States there are now nearly 500 electric plants operated by water power or water power and steam combined. Notwithstanding this, there are many hundreds of fine water powers totally undeveloped, or only partially developed, which would yield handsome returns on the cost of improving them and utilizing their power for the generation of electricity. Some are more favorably situated than others, but nearly all of them of any commercial importance can be developed.

The immense advantages of electrical development are its cheapness, the flexibility and divisibility of the power and the ease with which it can be transmitted from the point of generation to the point of utilization.

As a power producer the stream must be reasonably steady in the quantity of its discharge. This can be readily determined by pursuing the accurate methods employed in stream measurements by the government hydrographers.

Having ascertained the fall and the quantity of discharge, the amount of power that is available is readily determined. The next problem is the disposition to be made of the power when it is developed. This is often known in advance, but in some cases the power owners are confronted with many difficulties. The location of the power may not be suitable for a manufacturing site, and should it be desirable to transmit the power to manufacturing centers, existing power and light companies may own franchises which give them exclusive control of the territory. It is not always an easy matter to induce manufacturers owning expensive steam plants to discard them and substitute electricity, although they know it to be cheaper, more reliable, cleaner and generally safer than steam.

The problem of water-power development is, as a matter of course, one of dollars and cents, and the main question is, Will the income be sufficient to pay a reasonable per cent. on the investment, over and above general and operating expenses, taxes, maintenance and repairs and depreciation? This question is referred properly to the engineers in charge of the prospective development. The development naturally divides itself between the expert in hydraulics and the expert in electricity. To these experts it remains to solve all the varied and sometimes exceedingly difficult problems that are presented. The machinery for these plants must be constructed to suit the conditions imposed, and the conditions are the unknown quantities which enter the equations and are only solved by experienced engineers. The up-to-date manufacturers of water-wheels and electrical apparatus employ the best of engineering talent, and this talent is at the disposal of those contemplating the construction of water-power electric plants. Upon the engineers devolves the selection of the site for the dam and power house, and the preparation of plans and specifications for their building and equipment. The kind of dam and its location depend largely on the character of the stream, the shape and geological structure of its sides and bottom, and also the topographic features above and below the prospective site. Of course, dams are constructed to withstand extraordinary freshets and injury from ice and floating debris of all kinds, and of a height that will not cause disastrous results to surrounding property from overflow or backwater. Proper protection is afforded canals, waterways and penstocks leading to the power house, and ample provision made to keep sand and other detritus from entering the water-wheels. Local conditions are also important factors in the selection of the site for the power house. When practicable, it is located as near as possible to the source of power, so that the expense for canals, flumes and penstocks will be reduced to a minimum.

1. Abstract of paper read before the Franklin Institute, Philadelphia, June 19, 1899.

The plan of the power house depends largely upon the style of water-wheel used and the method adopted for delivering the water to the wheels and carrying away the discharge water, the connections between the water-wheels and generators, and whether the plant has additional or reserve steam power. The building and foundations for wheels and generators must meet every requirement of strength and solidity. The entire construction must also be fireproof. No power house is complete without a traveling crane.

Recent construction shows a very commendable desire on the part of engineers to standardize the building plans and machinery as far as practicable. The location of switchboards, transformers and outgoing wires is matter of detail for the engineers to decide. Currents of high voltage require extraordinary care in the placing and insulation of transmission wires.

There are at present two styles of water-wheels in general use in the United States for dynamo driving, viz., turbines and impulse wheels. As a rule, the use of turbines of the vertical and the horizontal style is confined to powers of ordinary head, where the water is plentiful. The impulse wheels are a necessity under opposite conditions. There are, perhaps, some exceptions to this statement, but I do not think them sufficiently numerous nor important to be cited at this time.

Both styles of water-wheels require the use of water-wheel governors, and this is especially true of plants where there is a variable load on the generators.

There are many different devices on the market for governing water-wheels. Reports from the plants show that the field is almost entirely covered by three governors, viz., the Replogle, the Lombard and the Geissler. They give remarkably close government under all working conditions, and guard against excessive speed or racing in case of the whole load going suddenly off, as in the case of circuits opening. Only last year you had an able paper read to you on the government of water-wheels, so that there remains little for me to say in connection with this subject, except that Mr. Replogle has perfected and brought out a new governor. It is well known that the voltage drops at the receiving station as the load increases on the line of long-distance transmission plants. This latest governor of Replogle can be so adjusted as to increase automatically the speed of water-wheels as the load increases, thereby holding the voltage constant at the distant end of the line. In making this advantage possible, he has not destroyed the principle that holds all the gates at several wheels to the same opening, where a number of units are running in parallel.

The kind of generators used, of course, depends largely on the length of the transmission line and the work required. For all long-distance transmission alternating-current generators are used. The voltage of the current generated is raised by transformers and carried at high voltage to the receiving station, and there stepped down by lowering transformers and utilized for light and power purposes.

The pole lines follow roads when practicable, and when run across country the timber is cleared from both sides of the line, so that uprooted trees and limbs broken by storms will fall clear of the line. The poles and cross-arms are of selected timber. The poles are firmly planted and securely braced at curves. Special high-voltage insulators are used. The transmission wires are bare copper, the high voltage permitting the economical use of light wires. The wires are spiraled, to prevent induction if telegraph or telephone wires are strung on the same poles.

A few statistics relative to water-power electric plants may be of general interest, and, since they were obtained after the expenditure of considerable time and labor, I will try to present them in such shape as not to weary you.

In the first place, the method employed for securing accurate and reliable data was by personal correspondence with the electricians in charge of the plants, a list of the plants operated by water power having been furnished me by the different manufacturers whose machinery was used in the plants.

There are nearly 500 water-power electric plants in the United States, representing an investment of over $60,000,000. The total horse power represented by water-wheels is over 200,000. The power is furnished for lighting 28,000 arc lights, 845,000 incandescent lights and for operating about 60,000 horse power of motors. There are over 610 miles of electric street railway operated by water power electrically transmitted.

The geographical location of the plants shows that the water powers have been electrically developed in proportion to the powers available. New England has no coalfields, but it seems that Providence has supplied this portion of the country with numerous large water powers. Of the 312 plants from which I have received reliable data, 115 are located in the states of Maine, New Hampshire, Vermont, Massachusetts and New York. Michigan has 26, California 25 and Colorado 11. The other plants are distributed among the other states.

It seems to be fairly well established that it pays to develop water powers from 50 horse power and upward, and that additional steam power is necessary when the water power is not sufficient to do all the work, and is not reliable at all seasons of the year. It is a well-settled fact that at the present time power can be profitably transmitted up to 80 miles, and utilized for any purpose for which steam power has been applied. In mining localities it has made possible the profitable reduction of low-grade ores that could never have been mined had steam been the only power available, owing to the enormous cost of coal and the difficulty of transporting it from the nearest point on railroads to the mines. In short, we find that our inventors have produced water-wheels, dynamos, motors and transformers of the highest efficiency, that governors regulate the water-wheels with the greatest precision, that insulators are made to safely carry currents of enormously high potentials, and that perfect protection is afforded the electrical apparatus from electrical disturbances caused by lightning.

Not until all electric-light and power stations are equipped with total-output wattmeters, and accurate books are kept, showing the exact amount of fuel used and all of the expenses of operating the plants, will satisfactory data be available for comparing the cost of producing current by the two methods—water and steam. When sufficient progress has been made in adopting uniform methods of keeping station accounts, and accurate and reliable data can be secured, it is my purpose to obtain and publish comparative statements, showing the cost of producing current by the two methods.

CORRESPONDENCE.

New York Notes.

New York, September 16.—The Manhattan Tunnel Railway company has petitioned the joint committee on railroads of the Municipal Assembly for a franchise to build a tunnel under Chambers street, beginning at a point 100 feet east of West Broadway and running thence under the North River to Jersey City. The projectors of the enterprise say that the tunnel is designed to furnish adequate transit facilities between this city and New Jersey, and they promise to complete it in two years, at a cost of $5,000,000, if the franchise is awarded to them. Frederick M. Laude, the engineer of the company, stated in an interview that the tunnel could be built without much tearing up of the streets. It would lie, he said, 35 feet below the surface, and would be constructed by what is known as the shield method. It is intended to furnish rapid transit for the 90,000,000 people who cross the river annually. Mr. Laude said the railroad would be operated by electricity and that the running time to Jersey City would be four minutes. A fare of three cents a mile or a minimum of five cents for the whole trip will be asked. David J. Newland is president of the company.

The action brought by the United Electric Light and Power company to recover damages from the city for removing and selling its overhead wires, which has been pending 10 years, terminated on Wednesday in a judgment for $6,000 against the city, granted by Justice Russell of the Supreme Court. The suit was for $250,000. Justice Russell holds that the action of the city in removing the wires both from the streets and housetops was authorized by law, but decides that the city had no right to take the wire and impound it and sell it as it did. The judge fixes the value of the wire, including interest, at $6,000, for which he gives judgment against the city.

The Stephen Merritt Automobile Burial and Cremation company is the latest exponent of a new plan to get rid of the dead "by liquified air and electricity." The plan of cremation, as Mr. Merritt sees it, is artistic. The body is conveyed to the establishment in an automobile. It is prepared for burial and taken to the top floor, where services are held. It is then lowered to the cellar and treated first with liquid air and then with electricity. The ashes are placed in an urn, which is given to the waiting relatives, who sit on comfortable chairs, surrounded by a blaze of electricity. The enterprise has received a serious set-back, however, as the Board of Health has enjoined Mr. Merritt from conducting any more experiments on account of complaints from those living in the vicinity of the experimental crematory.

As is generally the case with all sorts of new machinery, the automobile, like the trolley car, now and then claims a victim. On Thursday Henry H. Bliss, 68 years old, a real estate broker of 41 Wall street, was knocked down and run over by an automobile and was removed to Roosevelt Hospital, where he died the next morning, his skull having been fractured.

John D. Crimmins is having an electric ambulance built for St. Vincent's Hospital. The new vehicle, it is said, will run more smoothly than it is possible for one pulled by horse to do. It is capable of high speed, and on the asphalted cross streets it will prove a blessing in this regard in cases of great emergency.

The changing of the Broadway line of the Metropolitan Street Railway company from a cable to an electric road is likely to be delayed for some time. It is necessary to lay heavier rails for the electric cars than have been used for the cable, as those in use at present are practically worn out. The steel company which has contracted to deliver the new rails will be unable to do so for four or five months yet, although they were originally promised for September 1st. Work on the new power house of the company at Ninety-first street and the East River is steadily progressing, however. An official test of the first of the big engines in the new station was made the other day, and proved satisfactory to President Vreeland. There will be 11 of these big engines used to generate electricity, and they will supply the entire Metropolitan system.

Officials of the Brooklyn Rapid Transit company say that, since the Brooklyn strike, when hundreds of new men were hired by the company, the corporation has been losing a great deal of money through the stealing or "knocking down" of fares. It is asserted that the amount thus lost through the thefts of the conductors will amount to about $50,000.

G.

Canadian Intelligence.

Ottawa, Ont., September 16.—Promoters will apply at the next session of Dominion Parliament for the incorporation of a company to construct a railway between Ottawa and Brockville, Ont., to be operated by electricity.

In connection with the Boundary Falls water-power development at Rossland, B. C., a tunnel is being driven about 130 feet through the solid rock, and from the lower end of this tunnel to the power house there will be a flume 1,800 feet in length, supported on trestles. It is understood that a power plant will be put in later.

It was expected that the Yukon telegraph line between Skagway and Dawson being completed, construction would have been begun without delay upon the projected line connecting it with the British Columbia telegraph line at Quesnelle, by stringing a wire from the latter point to Telegraph Creek, on the Stikine River, and thence on through the Atlin district to Lake Tagish station on the Yukon line. It is now known that, for some unexplained reason, the Dominion government has decided to postpone operations.

Mayor Wilson of the city of London, Ont., announces that he will call a special meeting of the City Council to discuss the street-railway situation and push for municipal ownership. He has asked the city engineer to estimate the cost of an electric street railway paralleling the lines of the present electric street railway. The engineer has reported that the proposed road and the plant requisite for its operation would cost $500,000. This new project is in consequence of the long strike of the electric street-railway employes, which promises to continue to an indefinite length.

The commercial developments at Niagara have made vast strides during the last five years. There are at present 16 different works and factories that use between them power to the extent of 34,590 horse power. These include manufactories, electric railways, electric-lighting works, waterworks, etc. In October next two new works will be supplied with power, which will bring up the total to 45,190 horse power. The smallest amount of power consumed by any one concern is 20 horse power, and the largest 7,200. The income gained by the Niagara Falls company, which supplies the power, will, with the above-mentioned additions, amount to about $750,000 per annum. The operating expenses do not exceed $125,000, it is said.

A compound friction car brake has been invented by J. H. K. McCollum of Toronto and is now being used on some of the cars of the Toronto street railway. The brake can be applied to the axle of any car, and, obtaining its power from the momentum of the car, costs nothing to operate. Patents have been secured in the United States and Canada and a company has been formed to exploit the invention.

Dr. N. H. Edgerton of Philadelphia, Pa., the inventor of the high-tension storage battery, is building a factory at Hamilton, Ont., for the manufacture of the batteries in Canada. This means another electrical industry for the city of Hamilton, which will employ about 50 men. The equipment of electrical instruments and switchboards has been given to the Royal Electric company of Montreal. Storage batteries for street-railway purposes are to be the specialty of this concern, and with the advent of the electric carriage an immense field will be opened up for this class of apparatus.

The Montreal Electric Street Railway company has appealed against the assessment made by the city upon its poles, wires and rails under the new tax imposed in the city charter. The city's assessors have valued the poles, wires and rails of the company, independent altogether of their plant and machinery, at $280,000. The company has, it is understood, about 96 miles of single track in the city, so that the valuation is on the basis of $3,000 per mile. The company holds that the valuation for a similar tax in the city of Toronto is only $1,050 per mile of track, and asks that its assessment be reduced to the valuation imposed in that city. This would reduce the assessment to something like $100,000, instead of $280,000. The company also objects to the imposition of the special business tax on the basis of the assessment of its real property, including that already taxed under the poles, wires and rail tax. The company points out that, in reality, as the law is construed by the assessors, it is being taxed no less than three times on some of its property which the city charter designated as real property.

A meeting of the Royal Electric company of Mon-

treal has been called for the 26th inst., for the purpose of sanctioning the by-law for an increase in the capital stock. It is proposed to increase the stock of the company by $750,000, or at the rate of one share for every two at par. The present capital is $1,500,000 and the proposed increase will bring it up to $2,225,000.

At the regular meeting of the Montreal district assembly of Knights of Labor a few days ago considerable discussion took place over the advisability of petitioning the government to appoint experts to examine electrical plants. It was clearly demonstrated during the discussion that accidents resulting in a loss of life and limb had taken place through the neglect of the government in not appointing an inspector for this purpose.

Mr. N. Pinze of Montreal has invented a new street-car fender. It is made of slats of iron or wood fitted on to a frame, which is attached to the front of the car. These slats are concave in shape, but the edge above the track is oblique instead of straight. By an ingenious contrivance the motorman can, when he sees any object upon the track and in danger of collision, drop the fender so that its oblique edge will be only a fraction of an inch from the ground. The outside end of the fender is supplied with small wheels or rollers which rest upon the rails and prevent the fender from forming an obstruction to the forward motion of the car. In addition, this fender is supplied with springs, which relieve the shock of the blow inflicted by a body coming in contact with the fender. It is claimed that the oblique edge of the fender, together with the springs, will greatly reduce the danger of shock and will throw the body of a person struck by a car to one side. Arrangements are being made to have the new contrivance tested by the street-railway company.

All the Australian colonies interested in the proposed Pacific cable from Vancouver to Sydney have been discussing the subject of late. The Victoria Legislative Assembly has passed a motion declaring it expedient that the colony of Victoria co-operate with the United Kingdom, Canada, New South Wales, Queensland and New Zealand in the construction and working of a cable across the Pacific Ocean from British Columbia to Australia, touching at British territory only. Victoria is thus committed to the Pacific cable, and if the Extension company wants the Cape route, it must carry it out itself. In New South Wales nothing will be done in the direction of bringing the Pacific cable question before Parliament until a definite agreement has been arrived at on the subject. The latest phase in the matter is representation on the board which is to arrange all the preliminary business and prepare the tariff. The original proposal was that a board of eight should be appointed, comprising three delegates from Great Britain, two from Australia, one from New Zealand and two from Canada. The Australian colonies, and especially New South Wales and Victoria, considered that the representation for Australia was too small, and the suggestion has been made that the three Australian colonies and New Zealand should each have a member on the board. The matter is now under consideration of the home authorities.

The Ottawa Electric company has offered to sell out to the city its electric-lighting plant and patronage for the sum of $1,241,740. The Deschenes Electric company has modified its former offer by offering to supply the city with arc lights for street lighting, at the expiration of the present contract with the Ottawa Electric company, at the rate of $45 per lamp per annum, which means a saving of $20 per light on the present contract. It also offers to supply power for manufacturing purposes to the amount of 2,000 horse power, in lots of 25 horse power or upward, at the rate of $30 a horse power, to any new manufacturing concerns which may locate in Ottawa. The Metropolitan Electric company of Ottawa also offers electrical power up to 3,000 horse power, distributed in amounts of 20 up to 100 horse power, at a rate of $25 per horse power per annum, to encourage the establishment of new industries at Ottawa.

The Ragged Rapids-Orillia electric power-transmission scheme is now fully under way. The Electrical Maintenance and Construction company of Toronto, Ont., is the contractor in charge of the work. The entire electrical machinery, consisting of two 300-kilowatt S. K. C. two-phase generators, with 600 kilowatts in step-up and 600 kilowatts in step-down transformers, as well as the necessary switchboards and station apparatus, and one 50 horse power induction motor to drive the waterworks pumps, and one 50 horse power induction motor to operate the arc machine, is being furnished by the Royal Electric company of Montreal. Rapid progress is being made and it is expected that light and power from Ragged Rapids will be in Orillia between November 15th and December next. W.

Northwestern Notations.

Minneapolis, September 16.—The Benton Power and Traction company of St. Cloud, Minn., has let the contract to erect a power house and also to furnish a 500-volt generator for the new plant.

Medical men at Redwood Falls, Minn., are greatly interested and confused over the result of a bolt of lightning which struck Rudolph Luscher, who was on a grain stack, and burned him somewhat but did not do him serious injury. The terrible shock from the bolt, however, killed his son, Ernest, who was not struck, but was in a wagon throwing bundles to his father. Three horses were also killed.

The Board of Public Works of St. Paul is preparing to apportion the city into districts on which bids will be asked for lighting separately when the next lighting contract is let.

It is reported at Madison, Wis., that the persons interested in the street-railway system at Milwaukee have purchased the electric car line at Madison, and will extend and improve it. The report is denied at Milwaukee.

The Weyauwega (Wis.) Electric Light company is preparing to double its lighting capacity.

The Fox River Electric Railway and Power company of Green Bay, Wis., is about to extend its lines to Duck Creek, about five miles.

The Wieland Electric company of Duluth, Minn., which has a franchise at Sandstone, Minn., for an electric-light system, has turned it over to the Richardson Electric company, also of Duluth.

The council of Duluth, Minn., recently passed a resolution requiring the street-railway company to improve connections at transfer points and run cars oftener. The company says arrangements have been under consideration to do this for some time.

The council of Aberdeen, S. D., has decided to buy the electric-light and gas systems.

The mayor of Jamestown, N. D., recently vetoed an ordinance granting the Jamestown Electric Light company a 20-year franchise. He did so on the ground that the company had a franchise that still had eight years to run, claiming that an annullment passed by the council some time ago was not legal for the reason that the action could not be taken until the facts had been judicially determined, and that this had never been done. It is claimed, however, that the veto was filed too late, being filed on Labor Day. The council did not hold its meeting on the first Monday, as usual, but deferred it till the second Monday. The question is raised that the law requires the council to hold its meeting the first Monday of the month.

The council of Aberdeen, Wash., has granted a franchise for an electric car line to Mr. Dilman, who proposes a line to Hoquiam. R.

PERSONAL.

Clarence D. Patterson, superintendent of the Westmoreland Electric company of Greensburg, Pa., died suddenly on September 9th.

Mr. Gerard Swope, formerly of the engineering department of the Western Electric company, Chicago, now represents that company in St. Louis, Mo. The office is at 10 Security building.

Signor Marconi sailed for the United States on September 14th. He has arranged with Colonel Sumner, the United States military attache in London, for extensive military and naval tests of his system in America.

Mr. G. H. Atkin, who has been connected with the Thomson-Houston and General Electric companies for the last 10 years, has resigned his position, to accept the treasurership of the Woods Motor Vehicle company, recently organized in Chicago.

J. Franklin McGlensey of the Hipwood-Barrett Car and Vehicle Fender company of New York has opened an office at 449 Marquette building, Chicago. Mr. McGlensey is introducing his company's car fender and exhibits very ingeniously, by the aid of the mutoscope, a test which seems to prove conclusively the efficiency of the fender.

President C. J. Rolfe of the Rolfe Electric company, Chicago, appeared in New York last week after his attendance at the Municipal convention in Wilmington. Mr. Rolfe made the occasion of his eastern trip one of combined business and pleasure and did a most excellent business in placing his instruments with eastern companies. Mr. Rolfe was accompanied on his eastern trip by Mrs. Rolfe, who spent part of the time in visiting relatives in the East.

ELECTRIC LIGHTING.

The English (Ind.) Electric Light and Manufacturing company, which had been furnishing light and power in the town of English and also had been conducting the largest spoke factory in Southern Indiana, recently failed. Liabilities are said to be between $150,000 and $200,000, and the assets are unknown.

ELECTRIC RAILWAYS.

A franchise has been granted to the Salt Lake Rapid Transit company to lay a single or double car track in extensions of its electric road from Murray to Sandy, a distance of 5 7-8 miles.

Injunctions against the Worcester and Clinton Street Railway company of Clinton, Mass., and the Detroit (Mich.) Citizens' Street Railway company have been secured by the General Electric company, restraining the companies named from using motor and controller equipments which are adjudged to be infringements of the Condict patent (No. 393,323) for series parallel controllers.

The Detroit, Utica and Romeo Electric Railway company of Detroit has begun the construction of an electric railway to extend from Detroit through North Detroit, Warren, Utica, Disco and Washington to Romeo.

It is rumored that Chicago capitalists have secured a 30-day option on the purchase of the Chattanooga (Tenn.) electric street railroad, the two inclines to the summit of Lookout Mountain, and the broad-gauge road, extending several miles along the summit of the mountain.

Turner A. Beale, representing New York men, has purchased the City Passenger electric railway of Altoona, Pa., the Altoona and Logan Valley Electric railway and the Altoona Gas company, from John Lloyd, the principal owner. The consideration was $1,000,000.

The Birmingham (Ala.) Railway and Electric company has bought the Birmingham Traction company's electric street-car lines, and all the street-railway lines of the city have passed under the former's management, giving it 125 miles of track in the city and its suburbs. The consideration was in the neighborhood of $1,000,000. The purchase includes the electric lines to North Birmingham and Gate City and the Highland avenue line.

The Richmond (Ind.) Interurban Railway company, organized for the purpose of bringing new lines into Richmond, has begun work on a line between Richmond and Harrison, O. The line, when built, will pass through the following towns and resorts: Elkhorn, Locust Grove, Boston, Willis, Edgeworth, Goodwin's Corner, Cottage Grove, East Bath, Shultz, Dixon, Gladys, Mount Carmel, Sharplin, Glynare, Rockdale, Athens, and on to Harrison, O.

The Dunkirk and Point Gratiot Traction company has been incorporated in the state of New York, with a capital of $25,000, to build an electric road from Dunkirk to the shores of Lake Erie at Point Gratiot. The following are named as the directors of the company: Hotham C. Haggert, Lester F. Stearns, William Bookstaver, M. L. Hinman, E. R. Warner, A. J. Lunt and C. J. Karney of Dunkirk, A. H. Marsh of Fredonia and S. F. Nixon of Westfield.

The Union Traction company of Anderson, Ind., is now constructing an electric railway from Anderson to Muncie, 18 miles, and from Anderson to Indianapolis, 36 miles in length. The company, by consolidation, now owns the street-railway plants in Anderson, Muncie, Marion and Elwood, with the intervening interurban lines between Anderson and Marion, and Alexandria and Elwood. With the lines now under construction completed, the company will have about 160 miles of road, about two-thirds of which will be interurban and one-third within the towns and cities. The directors of the company are: President, Philip Matter, Marion; secretary and general manager, Charles L. Henry, Anderson; treasurer, George F. McCulloch, Muncie; James A. Van Osdol, Anderson; William C. Sampson, Muncie; Frederick Strauss, New York, and Randal Morgan, Philadelphia.

AUTOMOBILES.

It is reported that an automobile factory is being esatblished at Vineland, N. J., by Bouten & Bateman.

The Lewis Motor Vehicle Manufacturing company of Philadelphia has been chartered with a capital stock of $50,000. Among the directors are H. H. Simpers, L. Pyott, D. C. Clarke.

Within a short time the police department of Hartford, Conn., it is said, will be equipped with an automobile patrol wagon. If the experiment proves satisfactory, other wagons and an ambulance will be added.

The Automobile company of Los Angeles, Cal., has filed articles of incorporation, with $50,000 capital stock. Among the directors are I. B. Dockweiler, C. Johnson, H. E. Carter. The company will manufacture and sell automobiles and vehicles of every description.

The international exhibition of automobiles at Berlin was opened on September 3d. One hundred and twenty exhibitors had about 140 vehicles on view. An experimental line of electrical omnibuses was operated in connection with the exhibition by the General Omnibus company of Berlin.

The Illinois Central Railroad company is said to be experimenting with a gasoline velocipede motor car, to be used in place of handcars by trackmen. Three persons can be carried on the car, which alone weighs only 275 pounds, while an ordinary inspection handcar weighs between 500 and 600 pounds. The average speed is 35 miles an hour.

Henri Fournier, a noted French motocyclist, who has been prominent on American cycle tracks this year, recently issued a challenge to any motocyclist in the United States for a race on motor tricycles from New York to Boston or from Boston to New York. This challenge, says a New York dispatch, has been accepted by Kenneth A. Skinner of Wal-

tham, Mass., who made a trip from New York to Boston on a motor cycle in the spring.

Major Davidson of the Highland Park Military Academy, who is having an automobile gun carriage built for him at Peoria, Ill., expects to have it completed in time to go overland from Chicago to New York and take part in the Dewey celebration. He says he will then return to Chicago with his vehicle and take part in the parade on October 9th. Next spring he will go to Washington at the request of the Ordnance Bureau to exhibit his carriage.

The Munson company of La Porte, Ind., manufactures what is called a self-contained motor vehicle. It is a combination gasoline and electric machine, said to be free from starting devices which are used on common gasoline motors. The armature of the electric machine acts as the flywheel of the engine. A storage battery operates the machine as a motor in starting the vehicle, and after the engine begins to run, it in turn drives the electric machine as a dynamo and recharges the storage battery. It is claimed that this "electric machine is the governor of the engine and automatically supplies the extra power required when bad roads or hills are encountered." Ten gallons of gasoline, it is said, will furnish power to propel the vehicle 100 miles or more at the rate of five to 15 miles an hour.

PUBLICATIONS.

Steel-plate planing-mill exhausters, designed for the removal of chips, shavings, sawdust and refuse from woodworking machinery, are neatly illustrated and plainly described in a catalogue issued by the B. F. Sturtevant company of Boston.

A new catalogue is being distributed by the Ward Leonard Electric company of Bronxville, N. Y. It contains a comprehensive list of illustrations, showing different types of rheostats, theater dimmers, motor starters, speed regulators and circuit breakers.

A type of the Lombard water-wheel governor is being manufactured to regulate Pelton and other makes of impulse water-wheels and also small turbines. This governor consists of an hydraulic piston, which exerts its thrust in either direction, through the mechanism of a rack and quadrant, to a rock shaft, which is connected to the nozzle mechanism. It is manufactured by the Lombard Water-wheel Governor company of Boston and is described in a pamphlet issued by the company.

A catalogue of electric-light reflectors suitable for lighting churches, halls, theaters, stores, etc., is being distributed by Klemm & Co., 132 North Fifth street, Philadelphia. The manufacturers state that their reflectors are constructed upon strictly scientific principles, and that they will increase the light fourfold. The opal porcelain glass used is semi-transparent, thus allowing a small portion of the light to go through the reflector to brighten up the ceiling, and at the same time reflecting a large portion of the light. As a reflecting surface corrugated silvered glass is used, the corrugations in the glass making the light evenly diffused over the space required.

The third edition of the catalogue of the Electrical Engineer Institute of Correspondence Instruction of New York has been issued. The courses taught by the institute include all branches of electrical engineering, including electric lighting, electric railways, electric mining, telephony, telegraphy, mechanical engineering, mechanical drawing, etc. A strong feature of the institute's work lies in the fact that all its instruction papers have been prepared by eminent specialists and authorities in their respective fields. A complete synopsis in detail of every topic in every course which the institute teaches is an interesting feature of the catalogue. The institute is said to be meeting with remarkable success, due to the high standard which it has taken in the preparation of its instruction papers and the conscientious manner in which it deals with its students. Joseph Wetzler, M. E., E. E., is the president of the institute, and T. C. Martin, editor of the Electrical World and Engineer, is vice-president. Both these gentlemen are well known to electrical men, and their connection with the institute is a guarantee of its high standing. The institute's catalogue will be sent free to anyone on application by addressing the main office, 120-122 Liberty street, New York.

MISCELLANEOUS.

The Pittsburg local union of the Brotherhood of Electrical Workers is preparing for the national convention of the organization, which is to be held in Pittsburg the third week in October. Some 200 delegates are expected to be in attendance. A plan to make the national organization international will be taken up by the convention.

Successful attempts have been made in Vienna to transmit messages by means of space telegraphy to balloons. Three Austrian officers, together with Professor Thuma of Vienna University, conducted the experiments, using two balloons, one captive and the other free. The free balloon at the height of 1,600 meters (5,000 feet) plainly received the messages, and after it had floated away a distance of 10 kilometers (six miles) the signals were satisfactorily transmitted.

A French scientist is said to have devised a plan for preventing the leakage of gas from bottles containing champagne or other fermented liquors. He covers the cork and neck of the bottle with a layer of copper, deposited electrically. The bottle is coated with black lead or zinc powder and then placed in a bath and plated. After it has been coppered there will be no difficulty in plating on a copper base with either gold or silver. The process would be an expensive one.

Scientific men are manifesting much interest in the preparations now making by the Coast and Geodetic Survey, which is charged with the magnetic survey of the United States, for determining the accurate deviation of the compass at sea. Recent accidents at sea and the severe competition of ocean liners have called attention in a striking way to the need of accurate values of the deviation of the compass. The values of the deviation of the needle generally used are almost wholly dependent on the observations made on land, and little has been done by the United States to secure observations at sea. The vessels of the Coast Survey are being fitted with special magnetic instruments for these observations, and it is hoped that within a short time the Survey may be able to furnish values of the magnetic variation at sea nearly equal in accuracy to those on land.

The Elizabeth (N. J.) Journal of recent date says: The Lehigh Valley Railroad company is preparing to make South Plainfield an important point on the line, and will hereafter make it a coaling and water station for locomotives. A large trestle is being erected to receive the coal for the engines and all the latest electrical devices for loading engines with the supply are being put in. When the trestle is completed all the engineers will have to do is to move up to the trestle and the dump tender presses a button, letting out the coal, which is weighed as it goes, and drops into the engine tender. The engine can also take water conveniently near, and all will be done for both main line and branch engines in a very short time, without having to send the engines out on the Amboy branch. The workmen are digging now for the pit in which the motors for the operation of the coal dumps will be placed. It is expected the new arrangement will be completed by October, and the locomotives will begin then to coal at the new dumps. It is expected also that the coal-storage plant will be lighted by electricity.

TRADE NEWS.

Colonel Shay of the Chicago Belting company received a warm welcome on his visit last week in the East. Colonel Shay, as usual, was greatly rushed, but he had time to see a number of his old New York friends. He stopped only a short time in New York, but if he had remained long enough to greet all his friends his stay in New York would extend over a long period.

The firm of A. W. Knutson & Co., brass founders and finishers, 1076 East Main street, Galesburg, Ill., has been succeeded by the firm of J. L. Peterson & Co. Mr. Knutson, the patentee of the Knutson gravity clutch, has sold out his entire interest in the firm, as well as his interest in the gravity clutch, which has been manufactured by the firm, to Mr. Peterson. The clutch is giving the best of satisfaction and will continue to be manufactured by the new firm. The company will send free samples to any electric-lighting company, and says it will guarantee satisfaction.

The Chicago House Wrecking company has recently purchased the buildings of the Omaha Exposition, including everything that will remain on the grounds after November 1st, when the exposition closes. From the power plant and electric-lighting equipment the company will obtain possession of 125,000 pounds of waterproof, rubber-covered, insulated wire, about 30,000 incandescent lamps and sockets, 800 poles, three 350 horse power Westinghouse engines, one 275 horse power Atlas engine and one 150 horse power Ball engine. These goods, and, in fact, everything that is included in the sale, are now being offered for sale by the company.

The Manhattan General Construction company reports that its new direct-current Manhattan lamps are giving the best of service and its agents predict a large business for this fall. A shipment of 87 of these lamps has just been made to W. H. Elsinger & Co., St. Paul, Minn., owners of the Golden Rule dry-goods store, and a contract for 142 lamps for the dry-goods store of B. Nugent & Bro., St. Louis, Mo., has been awarded to the company, it being the highest of nine bidders. Among other orders mentioned by the Manhattan company is one of 60 lamps, secured through its Chicago agents, William Sharpe & Son, for the American Bridge Works of Chicago.

The electrical trade in general and particularly the many customers of the Edison decorative and miniature-lamp department will be interested to know that H. Westbury has been appointed successor to W. H. Meadowcroft, who not long ago resigned to assume the general managership of the Perret Storage Battery company of New York. Mr. Westbury is a gentleman thoroughly conversant with decorative-lamp work in all its branches, having been with the Edison lamp department for many years. No better choice of a successor to Mr. Meadowcroft could have been made. At the present time Mr. Westbury is extremely busy over the contract for decorative-lamp work at the Export Exposition in Philadelphia.

One of the features of the advent of electrically driven machinery has been the development of the electric fan. Originally the pulley-driven fan appeared to fulfill the requirements of the purchaser; soon, however, the steam fan, with direct-connected engine, displayed its utility, but to-day the fan driven by an attached motor has shown its general superiority, and is rapidly supplanting the steam fan. Progress along this line is claimed to have been largely due to the energy and foresight of the B. F. Sturtevant company of Boston, which has been known for years as one of the largest manufacturers of fan blowers in the world. For the last ten years it has been gradually, but surely, perfecting designs and keeping abreast of the times in this important branch of engineering. Recent publications of the company display the features of its electric fans.

BUSINESS.

The Central Electric company, Chicago, is ready to supply the trade with electric-heating and cooking devices. It requests correspondence with central-station men who desire to operate their plants under the highest efficiency by selling surplus current.

The Electric Appliance company, Chicago, reports the largest business in the history of the company. The increase is not confined to any particular line, but is evenly distributed among the arc and incandescent departments, street-railway, telephone and telegraph supplies, house goods, and, in fact, everything electrical.

The Columbia Electric and Manufacturing company of Chicago reports that it has recently received quite a number of orders for its electrical specialties, including principally telephone switchboards and parts thereof and springs of special shapes, with the dies for the same. This firm makes a specialty of the latter line of goods in connection with its manufacture of telephone switchboards and supplies.

The shooting in Iowa, Minnesota and South Dakota this year promises to be very good, as the rainfall in all these states was abundant. The best localities for chicken and duck shooting are said to be on and tributary to the lines of the Chicago, Milwaukee and St. Paul railway. A copy of a recent publication issued by the passenger department of that road can be had on application to George H. Heafford, general passenger agent, Chicago, Ill., by enclosing three cents in stamps for postage.

Notice has been given of the removal of the Chicago Rheostat company from Chicago to New York. Branch offices, with a large and well-assorted stock of rheostats, will be maintained at 1012-1013 Monadnock block, Chicago, to accommodate a well-developed western business, but the factory and main office will be in New York, in charge of Mr. E. W. Hammer, at 397 to 407 East Thirty-third street. While the growth of this company has shown a good increase, it is believed that the domestic business can be handled as well from New York, with a decided advantage in the handling of foreign trade.

Bullock electrical apparatus continues to find favor, especially among the more exacting users. Sales reported by the company for August embrace 52 machines, ranging in size from 2½ to 800 kilowatts' capacity. The orders were widely distributed throughout the United States, and two were from Great Britain. The latter were for the celebrated "teaser" equipment for operating large printing presses, one 50 horse power equipment coming from the Free Press of Aberdeen, Scotland, and four 50 horse power equipments from the Scotsman of Edinburgh. The company has just issued a new bulletin, which will be forwarded to anyone applying for it at its general office, Cincinnati, Ohio.

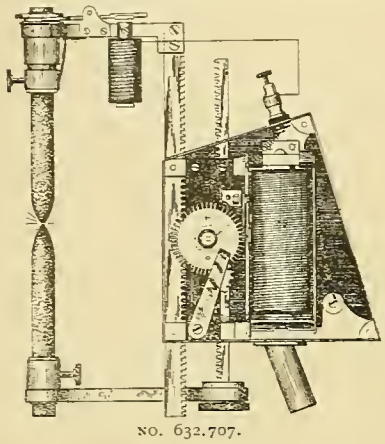
The Western Electrical Supply company of St. Louis reports that its summer and fall business has been unprecedented. It says that the good times are not confined to any one section of the country, but seem to be universal. The company states that its policy has always been a broad and liberal one, and with judicious advertising, liberal treatment of its customers and prompt shipments from stock, it has grown to be one of the largest electrical supply houses in the country. This firm is exclusive territorial sales agent for the Eddy and Warren apparatus, and has recently closed a number of very good deals for this apparatus in the Southwest. Special attention has been given to the Independent telephone movement, and the telephone department of the company is reported as being crowded with orders. The new 1900 telephone, which is being sent out on trial, subject to return at the company's expense if not satisfactory, is said to be meeting with great success. A complete stock of everything pertaining to the equipment of telephone exchanges and lines is carried.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 12, 1899.

632,707. Electric Arc Lamp. Theodore M. Foote, Chicago, Ill., assignor of one-half to Charles H. Seeberger, Chicago, Ill. Application filed June 15, 1896.

The lamp has a main magnet or solenoid for establishing the arc, a shunt magnet or solenoid to initiate the operation of the feed-regulating mechanism, a shunt circuit including the shunt magnet, a train of wheel work for feeding or permitting a feed of the carbons, a circuit-breaking escapement wheel constituting the driver of the train, a contact-making escapement lever engaging the escapement wheel, the escapement wheel and lever being included in the shunt circuit when so engaged, the shunt magnet operating to withdraw the lever into a position by which the escapement wheel in its rotation severs the shunt circuit, thereby permitting a feed of the carbons. (See cut.)



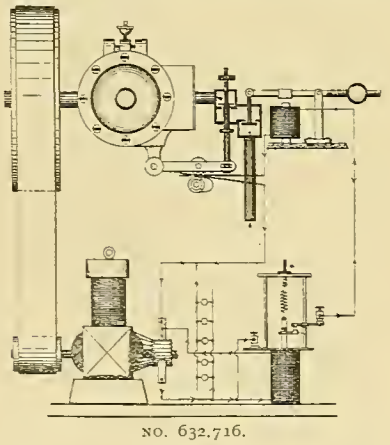
NO. 632,707.

632,709. Telephone System. Samuel B. Fowler, Tarrytown, N. Y. Application filed August 25, 1898.

The system comprises a main, metallic telephone circuit, an independent return circuit, and a source of current supply connected directly to one side only of the main circuit and to the independent return circuit, in combination with an induction coil having its secondary winding included in the main circuit and its primary winding connected at one end to the main circuit and at the other end to the return circuit, a receiver in the main circuit with the secondary winding and a transmitter included in the connections of the primary winding, whereby battery current flows over only one side of the main circuit and the return circuit.

632,716. Controlling and Regulating Mechanism for Engines. Thomas H. Hicks, Fort Wayne, Ind. Application filed October 21, 1895. Renewed April 3, 1899.

In a system of power operation and regulation are combined with a gas engine provided with a gas-supply valve a magnetic device for controlling the valve, a source of electricity for supplying the magnetic device with current to operate the valve, and a centrifugal governor for throwing the magnetic device in and out of electrical circuit to operate the valve for controlling the speed of the engine. (See cut.)



NO. 632,716.

632,733. Insulator for Trolley-wire Supports. John W. Meaker, Waukegan, Ill. Application filed September 11, 1896.

An insulator bolt having an inner coating of enamal or equivalent material and an outer coating of rubber or other elastic material.

632,739. Electric Meter. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 27, 1899.

The combination with a multiple-series supply circuit of current-consuming devices and an electric meter connected in operative relation thereto, a protecting cut-out for the meter, and an impedance in shunt to the cut-out. (See cut.)

632,749. Telephone Switchboard. Friedrich M. Richter, Chemnitz, Germany. Application filed November 21, 1898.

With the switchboard of an exchange office of telephone systems are combined a pivoted annunciator flap and a plug sleeve mounted side by side, the pivot of the flap extending just underneath the sleeve orifice, a cam fast on the pivot having two cam surfaces adapted, when the flap is down, to form a ridge extending into the path of movement of the plug in the sleeve, and a plug having a waist with shoulders between which the ridge lies, when the flap falls and the plug is in the sleeve, the plug being adapted to push the cam to raise the flap when inserted and to operate against the opposite side of the cam ridge with its shoulder when withdrawn to raise the flap again.

632,759. Telephone System. James C. Slater, St. Louis, Mo. Application filed May 23, 1898.

A telephone system is described, consisting of a switchboard having a switch for each telephone in the system, electrically controlled mechanism for each switch for operating the switch, telephones at outlying stations, a set of electric conductors running one from the frame of each telephone to its switch-operating mechanism and back to the frame, a series of contact points for each switch and in position to be engaged by the switch, a second set of conductors running one from each switch to each of the corresponding contact points of the other switches, a set of circuit-breakers, one at each telephone, for each of the first-mentioned conductors, means located at the telephones of supplying electrical energy to the circuits, mechanical means of operating and controlling the circuit-breakers, and a conductor connecting the telephones together and serving as a return wire for the talking circuits established by the operation of the switches.

632,772. Trolley. Robert White, Toledo, Ohio. Application filed May 25, 1899.

The trolley combines a trolley-pole with a forked head adapted to be secured thereto, provided with an ice scraper secured within and across the fork, and arched lips at the ends of the fork sides, having end portions projecting inwardly, above and partially over the crotch of the fork, with the center portions opening outward therefrom in a curve, forming together an open mouth-shaped opening for access to the scraper.

632,805. Automobile. William R. C. Corson, Hartford, Conn., assignor to the Eddy Electric Manufacturing company, Windsor, Conn. Application filed July 3, 1899.

An automobile is described having supporting wheels, an electric motor with rotary field frame having a tubular shaft, and an armature arranged to rotate oppositely, bearing boxes connected with the wheel axle and vehicle frame, bearings in the boxes supporting the tubular field-frame shaft, bearings in the tubular field-frame shaft supporting the armature shaft, gearing between the field shaft and a wheel on one side, and gearing between the armature shaft and a wheel on the opposite side. (See cut.)

632,849. Trolley Wheel. Ed M. Putnam and William Sellers, Haverhill, Mass. Application filed March 25, 1899.

A trolley wheel having a central hole countersunk at each end and a series of dovetailed recesses therein, and containing a suitable lubricating material, is combined with an axle for the wheel, cone-shaped bearings and means for locking the bearings in their positions, a space being formed between the central portion of the axle and the central portion of the hole in the wheel.

632,868. Electric Lock. Joseph R. Francis, Monroe, W. Va., assignor of one-fourth to John Devitt, Harding, W. Va. Application filed June 11, 1898.

The combination with a bolt of a pair of parallel adjacent contact plates in line with and in rear of the bolt within the limit of its throw, a spring for forcing the bolt against the contact plates, a pivoted armature lever engaging the bolt for holding it in forward position against the action of the spring, and an electric magnet for withdrawing the armature from the bolt and releasing it.

632,873. Voltaic Battery Cell. Henri de Ruiz de Lavison, Neuilly, France. Application filed August 12, 1898.

A voltaic cell is described which has an air conduit extending beneath the negative plate and formed with perforations beneath the opposite sides of the plate, whereby air forced through the conduit will escape in bubbles and ascend through the electrolyte along both faces of the plate.

632,874. Controlling of Electric Motor Vehicles. Henry Leitner, London, England, assignor to the Electrical Undertakings, Limited, London. Application filed September 27, 1898.

The apparatus combines with a motor a main generator and a small battery, a main circuit passing through the main generator, the armature and the small battery in opposition to the electromotive force of the latter, which has one pole permanently connected to the similar pole of the main battery, and an auxiliary circuit comprising the small battery and the field-magnet coils, the two circuits being connected only through the small battery.

632,896. Combined Engine and Dynamo. Charles C. Cowan, Memphis, Tenn., assignor to the Whitfield company, Memphis, Tenn. Original application filed September 14, 1898. Divided and this application filed January 6, 1899.

A dynamo is combined with a separate engine bolted to the pole-piece of the dynamo so as to be entirely removable therefrom, and an engine guide or guides formed directly in the pole-piece.

632,897. Combined Engine and Dynamo-electric Machine. Charles C. Cowan, Memphis, Tenn., assignor to the Whitfield company, Memphis, Tenn. Application filed March 18, 1899.

With a dynamo-electric generator, its armature shaft and a crank thereon are combined a pair of power cylinders removably mounted on the dynamo, pistons working in the cylinders, a piston rod common to both pistons, and means operated by the piston rod for rotating the crank.

632,932. Electric Brake. James E. Williamson, Allegheny, Pa. Application filed October 13, 1897.

A mechanism having a solenoid, comprising a resistance coil and a solid end or magnet having a coil therearound, the resistance coil being arranged in sections in series, means to supply electromotive force to the several sections and to the magnet coil, a core arranged in the solenoid, adapted to be moved thereby, and adapted to be connected with the brake chain or rod, means to engage the core and prevent its withdrawal from the cylinder of the solenoid when the same is de-energized, and means to release the core.

632,964. Electric Call System. Harry M. Dumas, Detroit, Mich. Application filed April 29, 1898.

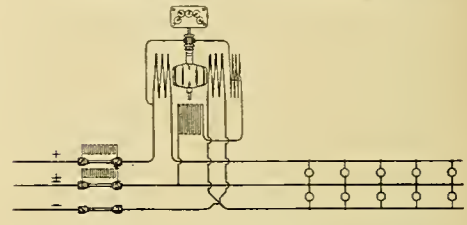
The combination with an electric call circuit and call mechanism therefor, of an arm or handle for manually operating the mechanism, a lock for arresting the movement of the arm or handle before it can operate the mechanism, an electromagnet for releasing the lock and a switch for cutting the magnet into the circuit adapted to be operated by the arm or handle in the initial movement thereof.

632,970. Electric Indicator. Frederick B. Pope, Augusta, Ga. Application filed May 15, 1899.

One claim mentions a frame carrying a cluster of independent magnets with the poles thereof adjacent to a common center, a shaft mounted within the center of the cluster, a needle carried by the shaft adjacent to the poles of the magnets, and means for laterally adjusting the needle in relation to the poles of the magnets, and means for separately exciting the magnets.

632,973. Conduit for Electrical Conductors. Mertie O. Spring, Philadelphia, Pa. Application filed December 9, 1898.

A conduit comprising a shell or casing and castings to which the casing is secured, the castings being provided with hooks or ledges for supporting the cables.



NO. 632,739.

632,980. Electric-railway Switch. Charles E. Young, Akron, Ohio. Application filed May 12, 1898.

A trolley-wire switch is described comprising a switch plate having guide flanges for directing the movement of the trolley wheel and a raised track sloping from the ends of the plate toward the center thereof and adapted to depress the trolley wheel when striking it, a main trolley-wire terminal at one end of the switch plate, a plurality of converging branch trolley-wire terminals at the other end of the plate, and a switch tongue normally connecting the main terminal through one of the branch terminals.

633,039. Detachable Connection for Electric Fixtures. Stacey G. Read, Bridgeport, Conn. Application filed May 13, 1899.

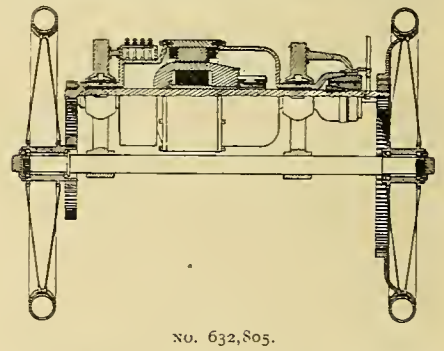
The connection comprises a fixed base having two parallel grooves extending from one edge inwardly or toward the center, two metal plates having electrical connection with the feed wires and secured to the face of the base outside the grooves, and projecting over the major part of their width, and a socket base having two projecting L-shaped arms in electrical connection with the conductors of the fixtures and adapted to enter the grooves and engage the plates whereby the fixture may be quickly slid into and out of place.

633,056. Anode. Arthur L. Walker, Perth Amboy, N. J. Application filed May 6, 1899.

An anode for use in the purification of metals by electrolytic separation is described.

633,060. Electrode. Marcel Wuillot, Brussels, Belgium. Application filed February 21, 1894.

For the manufacture of electrodes of accumulators a process is described which consists in transforming the surface of the plates into carbonate of lead, then placing the plates in an ammoniacal solution, and passing a current of electricity from one plate to the other, thereby converting the carbonate at the anode into peroxide of lead and at the cathode into spongy lead.



NO. 632,805.

633,064. Mine Locomotive. David L. Barnes, Chicago, Ill., and William P. Henszey, Philadelphia, Pa. Application filed March 20, 1896.

Combined in an electric locomotive are axles, an electric motor hung to one of the axles, its armature shaft being geared thereto, extensions on the motor, boxes adapted to the extensions and to the axle, and a frame resting on the boxes and from which the free end of the motor is suspended.

633,090. Engine Stop Mechanism. Louis St. Peter, Springfield, Mass., assignor to William H. Gray, Springfield, Mass. Application filed February 17, 1899.

The combination with any engine-controlling mechanism, as an ordinary governor, of an inclosed chamber having a diaphragm or piston therein which is operatively connected with the engine controller, a conduit for leading the pressure fluid into the chamber, having a valve, a self-operating valve-opening device, an electric circuit normally open with means for closing it and comprising a source of electrical energy, an electromagnet and an armature, the latter being arranged to operate as a detent for the valve-opening device.

633,095. Automatic Device for Operating Electric Switches. Isidor Deutsch, Baltimore, Md. Application filed November 2, 1898.

The essential features of the device are an electric circuit, a switch included in the circuit, a catch lever connecting with the switch which retains the latter in position to close the circuit, and an alarm clock having a vibrating hammer which is arranged to strike the catch lever and disengage it from the switch to break the circuit.

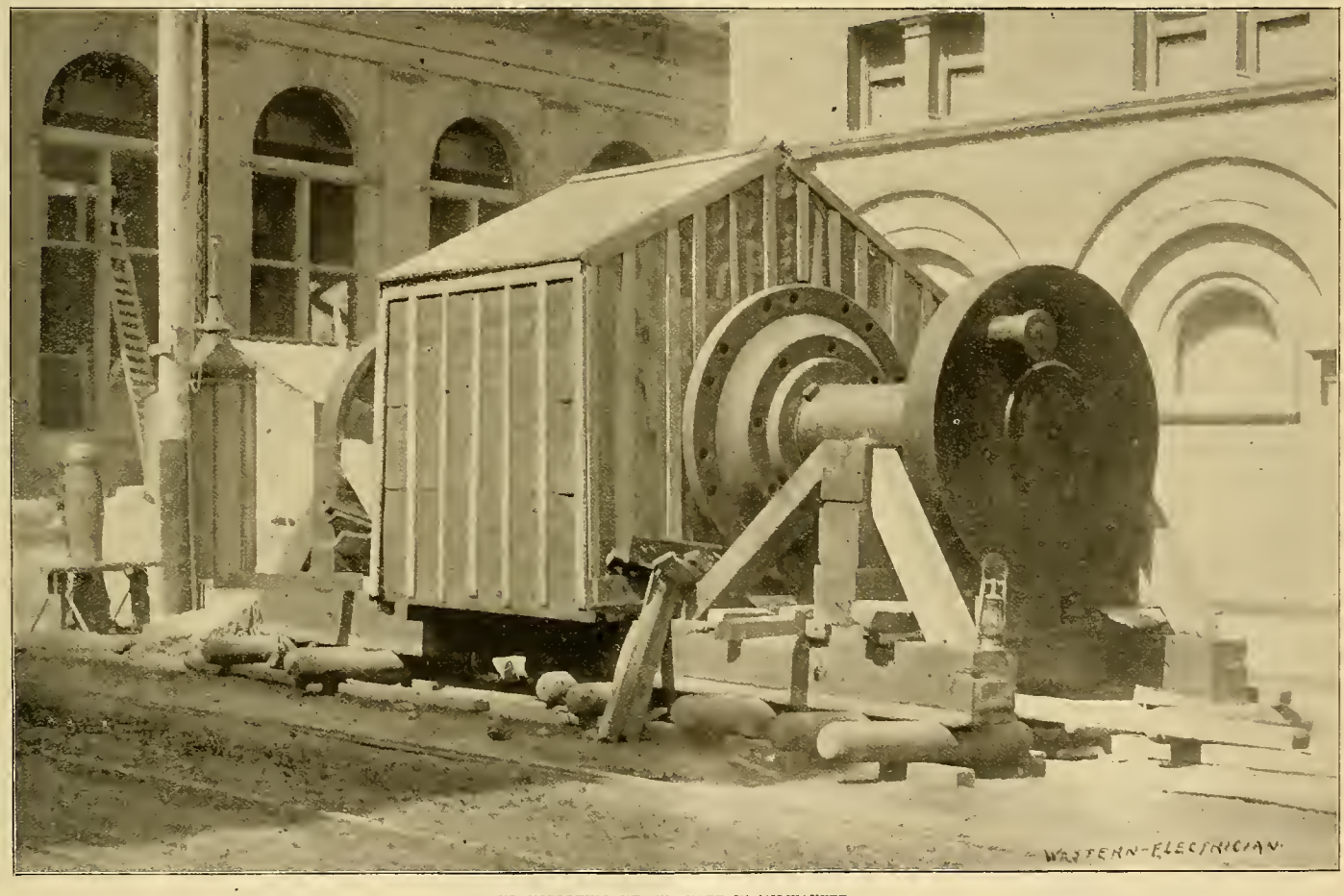
Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, SEPTEMBER 30, 1899. No. 14

Transporting Heavy Shaft in Milwaukee.

An interesting method of transporting a large shaft for a direct-connected electrical generating unit was recently employed by the E. P. Allis company in Milwaukee. The Milwaukee Electric Railway and Lighting company, which controls the 225 miles of street-railway lines in Milwaukee, has erected a new power house adjoining the old plant at the corner of Oneida and River streets. A 1,000-kilowatt, direct-connected street-railway generator was installed in the power house, among other new machinery, and the engine equipment was built by the E. P. Allis company. In the illustration is shown a view of the large shaft as it was being transported through the streets from the Allis works to the new power house. The armature was built up on the shaft in the factory of the Allis company by the General Electric company, which had the contract for furnishing the generator, and it is covered by the temporary housing seen in the illustration, to avoid exposure to the weather. In moving the shaft, which weighs about 60 tons, the ordinary method of moving houses through streets on rollers was adopted. The illustration shows the shaft at the end of its journey, the new power house in which it is to be placed being seen on the left. On the right is the Pabst Theater building. The distance the shaft was transported was about a mile and a half, and the route taken from the plant of the Allis company was across the Broadway bridge and down Broadway and East Water street to the power house at the corner of Oneida and River streets.



TRANSPORTING HEAVY SHAFT IN MILWAUKEE.

This method of transporting heavy shafts is, of course, not a new one, as the plan has been used in other instances where railroad facilities were not available. One instance that may be mentioned was the moving last spring of the shafts of the large generating units for the addition to the power house of the Metropolitan West Side Elevated Railroad company of Chicago. These shafts were also built by the E. P. Allis company and were transported on rollers through the streets from the nearest point on the railroad track to the power house on West Van Buren street, a distance of about one mile. However, in this case the shafts only held the armature spider in each case, while the Milwaukee shaft has all the armature windings complete. The Metropolitan shafts weighed 54 tons each and are now parts of the large vertical compound-condensing engines and the 1,600-kilowatt generators forming the two direct-connected units added to the plant at the Van Buren street station.

Joint Investigation of Municipal Ownership.

At the meeting of the League of American Municipalities, held in Syracuse last week, there was much discussion of the municipal ownership of public utilities. Mayor H. V. Johnson of Denver led the argument in favor of the extension of the powers of the cities. Papers in favor were read also from Gustav Tagel, mayor of Cincinnati; J. R. Robinson, mayor of Colorado Springs; F. G. Pierce, mayor of Marshalltown, Iowa. The speakers in opposition were M. A. Gemunder, former director of public improvements, Columbus, Ohio; M. J. Francisco, Rutland, Vt., and A. R. Foote of Washington. Mr. Gemunder considered municipal ownership unwise. He thought our democratic form of government, while excellent in securing to the members of the community their just rights, a flat failure when it entered the mercantile arena. The removing of industries from channels where the penalty for bad management was extinction and placing them where there was practically no penalty was a loss to the community. Then, in his opinion, the public would be best served by enlisting the skill and economy that accompanied private management. In the discussion in the evening Prof. E. W. Bemis, Mayor John MacVicar of Des Moines, Ia., and others spoke. The sentiment of the mayors present was in favor of municipal control of water and lighting.

During the discussion Mr. J. B. Cahoon of the Elmira (N. Y.) Illuminating company and a vice-president of the National Electric Light association presented a letter from President S. T. Carnes of that organization, suggesting a joint examination of municipal-lighting plants and offering to bear one-half of an expense, not to exceed $5,000, incurred in employing an expert for that purpose. Changed to include private as well as public plants, the suggestion was accepted and this resolution was adopted:

Resolved, That the offer of the National Electric Light association to pay one-half of the expense, not to exceed $5,000, to investigate municipal plants, the investigator to be appointed by the said association, be accepted upon the following conditions:

1. That the president of the league appoint one investigator and the president of the National Electric Light association another, these two, with any needed assistants, to investigate jointly and report on all points of agreement and disagreement.

2. That the investigation extend to the charges for domestic, commercial and street lighting, the cost of coal, the wages and hours of labor in private companies whose conditions are as similar as may be to those of the public plants examined. The presidents of the two associations, in conference with their expert investigators, are to select the plants to be examined, both public and private. In case of disagreement on this point, half of the public and half of the private plants are to be selected by each president.

3. That in view of the regular dues of the league being inadequate for even ordinary running expenses, the money for this investigation shall be secured by our treasurer from special donations, and our acceptance of the offer under consideration shall be conditional on the raising of this money, for which end we hereby request all those interested to contribute liberally.

Mayor Henry V. Johnson of Denver, a pronounced advocate of municipal ownership, was elected president of the league for the ensuing year. Next year's convention of the organization will be held in Charleston, S. C.

Magnets for Trolley Bases.

In a German contemporary Mr. A. Hecker proposes the use of solenoid magnets instead of springs for trolley-pole bases. The trolley pole must be allowed considerable up-and-down play, and it sometimes happens that on the trolley leaving the conductor the pole strikes and breaks a number of span-wires before the car comes to rest. In order to avoid this risk, the author proposes to dispense entirely with springs in the trolley base, and to substitute for them a coil-and-plunger mechanism traversed by the main current. If the trolley should be thrown off the conductor, the excitation of the magnet ceases and the trolley pole falls down by gravity out of harm's way.

Shop Practice.

A method of assembling a core disk at the West End street-railway shops is shown in Fig. 1. The shaft (A) bears on two supports, high enough for convenience in working. A collar is set-screwed on to this shaft at (B), and the disk head butted against this. Bolts (C C) are cut the right length, threaded and adjusted in the flange-piece and the disks slipped on, one at a time. This does away with much of the apparatus often used in assembling core disks.

Oiling of Machines.

It is worth while to take space to say a few words as to the oiling of those parts of the core

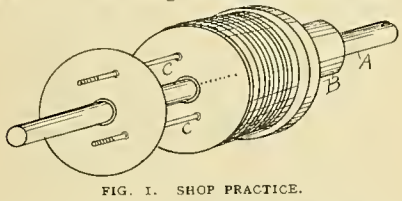


FIG. 1. SHOP PRACTICE.

shaft that are liable to heat. It should always be remembered that careful oiling means a saving of oil, but this is not the only benefit derived therefrom. The usual practice is for the operators of machines to oil up before starting, by taking an oil-can on which the spout has been enlarged so as to emit a large quantity of oil quickly. The operator pours the oil on the several bearings, never noticing, apparently, that more oil runs off than remains. For every drop of effective oil used, probably 20 drops are wasted, and may be found in unsightly blotches on the side of the machines, as well as on the floor, making any operation necessary around these parts dirty and disagreeable work. A drop of oil put in the right place will do good work, but to do this it is necessary to repeat the operation oftener, and this is the reason why the oil is slapped on in large quantities, so as to last all day.

Drying the Core Disk.

When the disks are on and ready for drying the electrical mechanic must look after the air. It is not enough to have plenty of hot air to dry the core, for often it is found that, after all, the parts

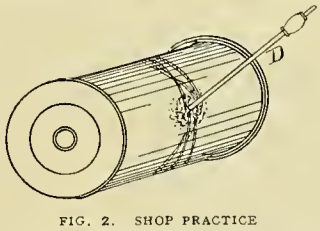


FIG. 2. SHOP PRACTICE

refuse to dry, even with a plentiful supply of hot air. This is due to the fact that the air has become saturated with moisture, and if this moist air is not given a chance to get out of the drying box, the parts will not dry. Therefore, one should see to it that the air has a chance to get out as well as in, and then there will be no trouble.

Taking Temperature of Full Coil.

In Fig. 2 is shown a good method for taking the temperature of a hot part. First etch the scale of degrees on the stem of a thermometer (D), and bind this to the heated part, as shown. Cover the bulb with waste to prevent the radiation of heat; the reading may be readily taken when the column of mercury has ceased to rise.

How to Wind a Drum.

In making a taper for cloth to be put on a drum, cut the cloth down the middle, about half-way round the cylinder, then gradually taper off, until within

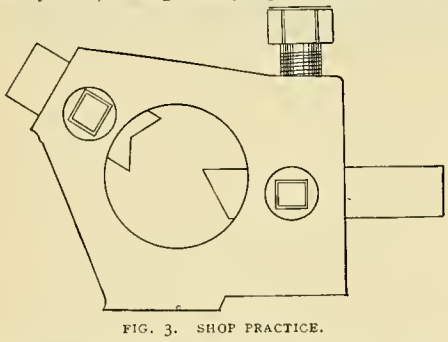


FIG. 3. SHOP PRACTICE.

six inches of the distance around. Then, having tacked the two ends of cloth where they meet, begin to taper on the inside of the cloth next to the edge of the first row placed on the cylinder, until a smooth, even taper is obtained, gradually increasing the width of the cloth until its full width is reached. The second part of this taper will only need to be three or four feet long. A strain of about 75 pounds should be used on the rows, gradually increasing the strain as the cloth increases in width, and when the full width of cloth is reached a strain of 250 pounds should be used. When it is time for the tapering off to begin, at the end of the cylinder have a strip of cloth to use as a gauge, and keep winding the cloth on the cylinder until the four rows will just fit between the flange. Begin here to taper, always leaving just space enough between the cloth and the edge of the cylinder. The last end of the taper will then be cut down four rows in width, the same as the other taper was started.

Cutting Tool.

In Fig. 3 is a useful home-made form of cutting tool for turning down the ends of the core shaft. The cutting edge is on top and the adjustment is made with a hammer. After the shaft has been running a few days, the cylinder should be tried with the gauge, to see that it is running free, for however accurately it may be set when the machine is first started, it sometimes happens after a short time that the machine will change its position, allowing some parts of it to come together.

The Repair Shop.

The pattern room of the repair shop should be provided with tiers of shelves, divided into apartments and numbered and lettered. A list card is tacked at one end of each tier and all patterns are listed on this. The letters represent a certain class of machinery or parts of machinery. (A) is the symbol for patterns belonging to a certain piece. (B) may represent the parts of a motor, and (C) some other machine, and so on. The numbers will run from (1) to as many numbers as are required to designate each piece in motor, etc. For example, (A-5) may be the listing for a particular bolt, nut, set-screw or connecting rod; (B-1) is the symbol for a particular piece of a motor. The corresponding number of each is stenciled upon the sectional apartment containing the article. This system permits the foreman of the shop to keep track of the work and designate to his men just where a particular pattern is to be found. The foreman's book of patterns contains the key to the letters and numbers, and when a machine is run into the shop for repairs, the foreman simply ascertains what new parts are required, refers to his book and makes out the repair card accordingly. The machinists can quickly find the parts by referring to their tier let-

REPAIR SHOP ORDER No. 47

DATE.. May 1. 1898

CAR No. 360 FOREMAN. John Smith

REPAIRS Worn bushing in forward truck

SYMBOL	PIECES	MACHINISTS	REMARKS
A — 2	Journal wing	Jones	Rush.
A — 4	Brass sleeve	Brown	

FIG. 4. SHOP PRACTICE.

ter and section number. Fig. 4 shows the details of the ticket.

Repairing Worn Cones.

In Figs. 5 and 6 is shown an easy method of repairing a worn or a scored cone. First, a steel mandrel should be turned down, cut with a thread and put into the cone, as in Fig. 5. The mandrel may now be held in the chuck of a lathe, while the worn or scored place in the cone is turned off even. If it is not convenient to put in a threaded mandrel use a clasp, such as is shown in Fig. 6, in which the core of the mandrel is smooth and the cone held by the nut. As it is necessary to soften the steel previous to turning down the cone, it will be necessary to restore the temper again. First heat the cone to a cherry red, dip it in water and finish it off with emery-cloth, and the cone will be as good as new.

Tightening a Loose Key.

A loose key may be tightened as follows, if it is the key-seat that is worn: The old key-seat is first dovetailed out, as shown at (A), Fig. 7, and then a steel wedge (B) is put in, as in Fig. 8. The dovetailing can be done with files. If milling cutters are used, the cutters should have their working faces at an acute angle or end, instead of on the periphery, and should have their teeth cut slightly tangent, instead of radial, in order to give them the effect of a draw cut, like that caused by the spiral edge of flat cylindrical cutters.

Dies for Light Repair Work.

Dies are now often used in repair-shop practice, and the accompanying pattern may be serviceable. The diagram (Fig. 9) shows a section of the male and female die, which is applicable to the making of small parts, blanks, star gears, etc. Shanks (A A) of the male die fit into the reciprocating shafts of the press, and are held by keys (B B). The female die (C) is connected to the cross-head (D) by the pins (E E), and the latter are set in the lift plate (F). The shaft (G) passes into the lift plate, as shown, and its lower end connects with the elevating and depressing mechanism of the press. The core pins (H H H) are of hard steel, and conform to the bores (I I I). These pins perforate the metal of the part in the mold, making a clean, smooth hole.

Phœnix Battery Company versus Carbon Trust.

In St. Louis on September 20th papers in a replevin suit for the machinery and plant which has been operated at 2120 to 2140 De Kalb street, by Samuel G. Booker and the Phœnix Battery Manufacturing company, were filed in the United States Circuit Court by attorneys representing the National Carbon company of New Jersey. The value of the plant is estimated at $10,000, an additional $10,000 being asked as damages. A United States marshal seized the plant and the dispute will be settled in court.

The trouble grows out of the formation of the

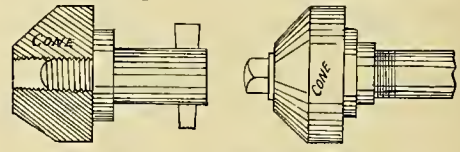


FIG. 5 AND 6. SHOP PRACTICE.

carbon trust. The original carbon company in St. Louis was the Phœnix Carbon Manufacturing company, and Col. S. G. Booker was the manager. The National Carbon company, known generally as the "carbon trust," sought to absorb the local concern, so it secured an option on the plant. This option was secured last January, and on March 15th, according to the St. Louis Globe-Democrat, the sum of $175,000 was paid for the company's interest in the manufacture of carbons for electric lighting and brushes for motor cars. The company retained an interest it had in the manufacture of carbon specialties, such as supplies for telephone and telegraph batteries.

After the sale of the concern to the National Carbon company, the stockholders and officers organized a new company under the name of the Phœnix Battery company. There was a clause in the contract for the sale which provided that possession should not be given of the plant until after written notice had been given and six months had expired.

It is the claim of Colonel Booker that no notice has been given to any one of the officers or stockholders of the company, and that hence there was no occasion for giving possession of the property. According to the statements made by Colonel Booker,

FIGS. 7 AND 8. SHOP PRACTICE.

he has secured an option on all of the stock of the newly organized company and he expected to start a plant of his own as soon as the buildings could be erected. For the purpose he bought eight acres of land on the Oak Hill railway, near Chippewa street, and has the foundations of his buildings already laid. He declares that it is his purpose to build up a new business and says that there is nothing in the obligations of himself or anyone else who was a party to the sale of the old plant to prevent him from doing this.

Mechanical Engineers at Franklin Institute.

A Philadelphia dispatch says that the Franklin Institute of Philadelphia, under the auspices of the National Export Exhibition, will celebrate its seventy-fifth anniversary on October 10th by holding

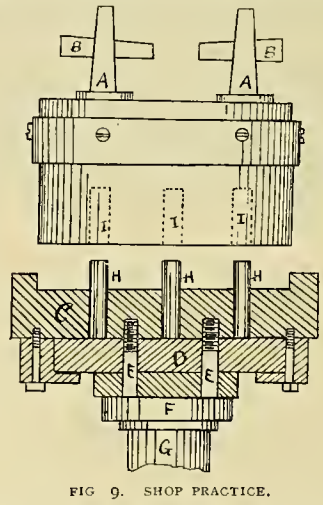


FIG 9. SHOP PRACTICE.

a congress of mechanical engineers in the Auditorium. Dr. Thurston of Cornell University and Rear-admiral Melville, engineer-in-chief of the United States Navy, have been invited to read papers, the former on "Improvements in the Work on Shore Engines," and the latter on "The Advance Made in Marine Engines." There will be other papers on relevant subjects. The attendance promises to be large, as the Franklin Institute is one of the foremost of the recognized scientific bodies of the United States.

Niagara Power Development Notes.

The Niagara Falls Power company has called for bids for the construction of a new wheel-pit. This wheel-pit is to be located on the inlet canal, opposite the present central station. It will practically be a duplicate of the present pit, which is over 400 feet long, 179 feet deep and 20 feet wide. It will provide for an additional development of 50,000 horse power, and this will bring the company's output capacity up to 100,000 horse power. The contracts will be opened on October 5th and they will call for the construction of all necessary connecting tunnels. When the inlet canal was built the masonry for the inlets was placed in the walls, and when the tunnel was built it was constructed large enough for the development of 120,000 horse power, so that these features of the development are ready for the project.

While the Niagara Falls Power company does not state the number of wheels to be installed in the pit at the start, it is sufficiently encouraging to know that contracts will be let for the construction of the entire pit. This indicates a rapid development of power, for when the development was in its initial stages the first wheel-pit was 140 feet long, and this was afterward extended to the present dimensions. Now an entirely new pit is to be built.

To the engineering and scientific world this announcement on the part of the Niagara Falls Power company is full of encouragement and meaning. It not only indicates the full success of the greatest power development in the world, but it tells that it is to be carried to a point practically impossible for any other hydraulic development to attain, except in the vicinity of Niagara. Ever since the Niagara turbines and generators were started the place has been the Mecca of scientists and electricians. With this projected development completed, it will become still more so.

Contracts have been awarded by the Canadian Niagara Power company for sinking test holes along the route of the proposed power tunnel on the Canadian side of the river, in order that it may be determined with accuracy just what kind and conditions of rock the tunnel will be built through. The information gained by these test holes will be valuable to bidding contractors, as well as to the company. The holes will be 200 feet deep and 4½ inches in diameter. They will be sunk by a diamond drill in order that a core of rock may be brought to the surface for inspection. It will be recalled that when the tunnel on the New York side at Niagara was projected similar test holes were sunk. The size of the tunnel that the Canadian Niagara Power company will build is not as yet announced, but it is well known that it will be sufficiently large to furnish tail-race facilities for the development of a very large amount of power. The tunnel on the Canadian side need not be so long as on the New York side, the site of the proposed development being quite different and near the gorge. For this reason the cost of the Canadian tunnel will not be so great as that of the New York tunnel.

The French-Hickman Fiber company is building a pulp mill on the lands of the Niagara Falls Power company at Niagara Falls that will be operated by electric power. The site is just east of the big power house, and 500 electrical horse power and 500 steam power will be used at the start. The factory expects to get in operation by spring. Work is now in progress on the buildings. They will be of brick and iron. One will be 384 feet long by 56 feet wide, while another will be 276 feet long by 54 feet wide. These two buildings will be connected by a building 100 feet long and 54 feet wide. The French-Hickman Fiber company is an English concern, of which B. F. French of Boston is the managing director, while Stanton Day of Niagara Falls will be the manager. The capital of the company is $750,000. The output capacity of the plant when it starts is expected to be 10 tons a day. The company has a branch in Fargo, N. D., and it is from that locality that the raw material will be obtained. This raw material will be flax straw, and it will be treated in the Fargo plant before shipment to Niagara Falls. The product of the Niagara plant will be used in the manufacture of high-grade papers, and it is said the material has already been successfully tested.

Electrical Decorations for the Fall Festival.

Contracts have been let for the street decorations for the fall festivities to be held in Chicago from October 4th to 10th, and the masts and columns to decorate State street, between Van Buren and Lake streets, are being erected. The electrical features of the display will be handled by the Chicago Edison company, which has contracted to furnish about 4,800 incandescent lamps. These lamps will be strung about a foot apart on the festoons that are to connect, transversely, the masts on either side of State street, and will be bunched at the center and ends of each festoon. It is also probable that two powerful searchlights will be placed on each of the large arches being erected in State street at Lake and Van Buren streets, so as to illuminate the court of honor between them.

Several of the large buildings in the downtown district will be elaborately decorated with bunting, flags and electrical designs. The Union League Club will be illuminated by several hundred lights, and other buildings, such as the Board of Trade and the Fair store, will be extensively decorated. The Union Elevated Railroad company will erect an immense American flag made of colored electric lights at its Van Buren and State street station, and the entire loop will be decorated.

Gas Engines in Central Station at Bradford, Pa.

A new industrial situation is being entered upon. Gas is contesting the position of steam as a motive power. Heat is but one of the products of coal, whereas there are many by-products of great value which are lost when coal is used for fuel alone. By utilizing these by-products gas can be produced at a very low cost, reducing the expenditure for generating electricity, it is contended, materially below the cost of generating electricity by steam.

As these facts become more clearly recognized, it seems to be likely that a great demand for large electric power units will arise, for which the motive power will be furnished by gas.

A more general use of gas for fuel would modify the present practice in electrical installations. The customary outlines for large electrical plants of recent construction are about as follows: A central steam-boiler plant and electric-generating units, the generators being of the polyphase type, for supplying currents at high voltages; a high-tension system of distribution to carry the currents to local sub-stations, where step-down transformers lower the high-tension alternating current for rotary converters, which in turn feed direct current to distributing circuits, for lighting and power purposes. If the steam-engine and boiler plant at the central station were supplanted by a gas-generating plant, the gas could be conveyed, by pipes, to the various sub-stations, and used as fuel for gas engines, to generate electrical current locally at each station. It is estimated that a gas engine, say of the Westinghouse type, and electric generator, even of moderate size, can be installed, ready for operation, for a sum materially less than that required for a steam-engine central-station plant and its system of distribution. It is now claimed that the modern gas engine is admirably adapted for electric lighting, as its economy is very high and its speed regulation as good as that of a first-class steam engine.

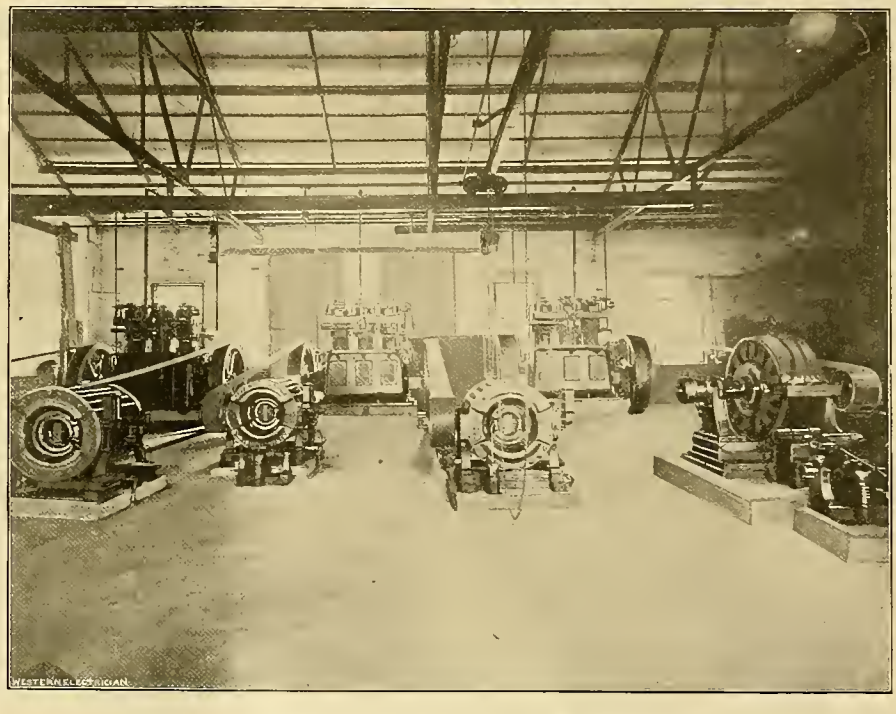
This new industrial situation is finding rapid exploitation. The Columbus Electric Light company, Columbus, O., is installing 1,000 horse power of gas engines, supplanting a like amount of steam engines. Another interesting gas-engine equipment is that of the Bradford Electric Light and Power company, Bradford, Pa., which has contracted with the Westinghouse Machine company of Pittsburg for three gas engines of 125 horse power and one of 200 horse power. The illustration gives a view of the interior of the Bradford power house, showing three Westinghouse gas engines already installed, driving electric generators, with space for the fourth engine. The new gas-engine equipment replaces four automatic high-speed steam engines of the same power, two of which were belted to a jack-shaft, from which dynamos were driven, the other two being belted to dynamos in a wing off the main engine and dynamo room. Steam for the engines was supplied by four 100 horse power, horizontal-return tubular boilers, fired by natural gas. The amount of gas consumed for steam engines amounted to 52 cubic feet per indicated horse power per hour.

By the substitution of gas engines, a more convenient arrangement of the floor space in the engine room has been made, by placing the four engines on one side of the main room and belting them direct to the dynamos. Two of the 125 horse power gas engines drive four arc dynamos, two to each engine. One of the alternators is so placed that, if necessary, it can be driven by one of these engines. The third 125 horse power engine drives the second alternator, and the 200 horse power gas engine will drive a 125-kilowatt Westinghouse alternator.

The Bradford plant is a noteworthy one; it is the first extensive electrical system in which steam power has been entirely displaced by gas engines for supplying electric-light service. The consumption of natural gas was guaranteed by the Westinghouse Machine company not to exceed 13 cubic feet per brake horse power hour. The saving, in fuel alone, as compared with the former consumption of 52 cubic feet of gas, will be a large item and pay a handsome percentage upon the investment.

The floor space saved by the present arrangement of engines and dynamos, and the boiler space, will be of value when additions have to be made to the present plant. The saving in boiler repairs, brickwork and labor in boiler room is another considerable item. Better supervision is secured, as all the work is now concentrated in the one room.

A Clayton air compressor, driven by a small gas engine, is used to charge two air reservoirs placed overhead in the engine room. The compressed air is used to start the gas engines. The small gas engine also operates a triplex pump, which furnishes water to the jackets of the gas engines for cooling purposes.



GAS ENGINES IN CENTRAL STATION AT BRADFORD, PA.

At the present time it is too early to state what the average consumption of natural gas will be, but, from records already taken, the cost of fuel for one engine, working 102 arc lights, is about $1.12 for eight hours' service. The future working and development of this plant will be a valuable guide to users of power and will be watched with keen interest.

American Electro-therapeutic Association.

The American Electro-thearapeutic association held its annual meeting in Washington on September 19th, 20th and 21st. Many men prominent in the medical profession were in attendance at the sessions of the association and a number of interesting and valuable papers were read. At the executive session held on the evening of Wednesday, the following-named officers were elected for the ensuing year: President, Dr. Walter H. White of Boston; first vice-president, Dr. Percy Hickling of Washington; second vice-president, Dr. Charles O. Files of Portland, Me.; treasurer, Dr. Richard J. Nunn of Savannah, Ga.; secretary, Dr. George E. Bill of Harrisburg, Pa.; two members of executive-council to serve three years, Dr. Charles R. Dickson of Toronto, Canada, and Dr. Frederich Schavoir of Stamford, Conn. It was decided to hold the next meeting of the association in New York City September 25, 26 and 27, 1900. Greeting of the American Electro-therapeutic association was sent to the body of similar character recently formed in Italy.

DEVELOPMENT OF THE TELEPHONE FIELD.

Privacy of Telephone Communications.

By H. P. Clausen.

Part III.

When the writer undertook to prepare a series of papers on the privacy of telephone communications, he did so with the intention of suggesting a practical method for circumventing or "getting around" every one of the numerous schemes that might be employed by persons possessing an ordinary degree of electrical knowledge, for cutting in and becoming a party to the conversation held by the lawful users of a telephone system. After going into it more thoroughly, however, the problem assumed an aspect which prompts the writer to venture a suggestion, i. e., that the recent and much-discussed million-dollar offer for a successful telephone repeater might safely be made to include an "eavesdropper-proof" telephone system. Briefly, the conclusion arrived at is that it is exceedingly difficult, if not impossible, absolutely to protect a simple one or two-wire telephone circuit against the possibility of an unauthorized person learning the nature of a message passing over the circuit.

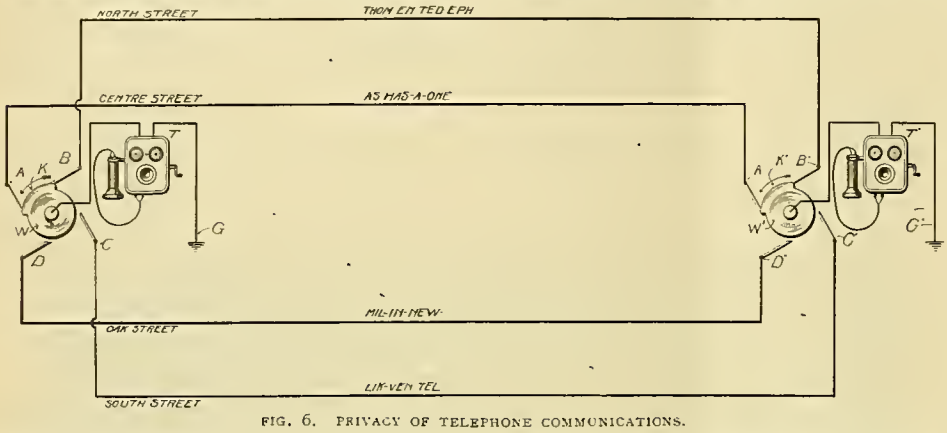


FIG. 6. PRIVACY OF TELEPHONE COMMUNICATIONS.

In order to determine the correctness of the above statement the writer believes that his readers would be pleased to hear from anyone entertaining a different opinion.

While it may be impossible by the use of one or two wires to produce an "eavesdropper-proof" telephone system, it does not necessarily follow that a distribution of wires cannot be designed that will make it practically impossible for an unauthorized person to cut in or attempt to cut in on a circuit without giving some notice of the attempt to the rightful users, or at least to thwart the eavesdropper's purpose of understanding messages that are being transmitted.

The writer is not aware that such a system has ever been used in practice or even designed. Therefore, the method outlined by Fig. 6 may serve as a fair indication of what might be accomplished in that direction. Referring to the figure, (T) and (T') represent two telephone-station instruments, with one side of each connected with the ground (G). The remaining terminal of each connects to the contact wheels (W, W'). The telephones may be of any ordinary exchange type. The contact wheels should be provided with a self-locking clock movement, so constructed that the current required to be generated at the caller's station for attracting the desired correspondent's attention will at the same time serve as a means for setting the clockwork in motion and cause the wheels (W, W') to run in perfect synchronism and uninterruptedly, until another impulse of current is sent over the circuit, which will again lock the wheels into a normally resting position.

On the outer periphery of the contact wheels, it will be observed, there is an extension (K), which is provided for the purpose of successively making contact with a set of four springs or brushes (A, B, C and D). Following the circuits, it will be noted that the (A) brush connects with the (A') brush by means of a wire strung along Centre street. The remaining contact brushes are likewise connected, but by a separate wire for each, as shown, the (B) wire passing along North street, (C) along South street and (D) along Oak street. Thus, it will be seen that normally (with the wheels at rest) the North street wire presents the only electrical connection for the (T) and (T') telephone stations, and if a communication were passing over the circuit it would be a simple matter to cut in on the North street wire and "listen in."

However, before commencing to speak, the caller, say at station (T), must apply a little energy to his telephone-signal current generator, and thereby sound the signal receiver at the (T') station. Now, if it be remembered that the same current which operates the signal receiver will also start to "make the wheels go round," so to speak, it is easy to see that while the North street wire was the normally connected circuit, the Centre street wire would be cut in, and the North street wire cut off, at the moment the clockwork commenced to revolve the wheels (W). The same would be true with the Oak and South street wires, each circuit being successively cut in and out to the exclusion of the remaining wires. But, inasmuch as an actual circuit is maintained between the telephone stations, there exists no bar to uninterrupted transmission of messages, the only requirement being that the contact wheels must move in perfect unison with one another.

With the above construction and the clockwork suitably proportioned for driving the wheels (W) at a rate of about 60 revolutions per minute, an eavesdropper listening to a conversation passing over the North street wire probably would be treated to a strange series of wholly unintelligible sounds. Thus, for example, the sentence "Thomas Milliken has invented a new telephone," if spoken into the (T) telephone transmitter, would be perfectly plain at the (T') station receiver, but the entire sentence will really have been conducted to the receiving station over the four wires in fractional sections. Each wire would carry a part of the conversation, and the sounds heard by the North street eavesdropper would be a jumble something like this: "Tom-en-ted-eph." The same rule would apply to the remaining wires, with the difference that each wire would be found conveying a different section of the message transmitted.

The chief advantage of the system as described lies in the fact that the line wires, being several blocks apart, must be connected together and through a telephone receiver to earth before an eavesdropper can learn the nature of a message passing over the circuit.

Anticipating that the possibility of connecting all of the wires together permits of listening in on a circuit, and that this danger may be construed as a serious objection to the proposed system, the writer prepared Fig. 7, which represents the (T) station shown in Fig. 6. (T) represents the telephone connected to earth (G), wheel (W), and through the brushes (A, B, C and D) to the line wires. Immediately behind the brushes, it will be observed, there is a contact point (P), which is connected to one terminal of a loud-speaking telephone receiver (R), provided with the sound-amplifying funnel (F). The remaining terminal of the receiver is connected to the break side of an electromagnetic vibrator (V), which is supplied with current from the battery (B). One terminal of the electromagnet (M) is connected to the battery direct, while the remaining side connects to the armature (A).

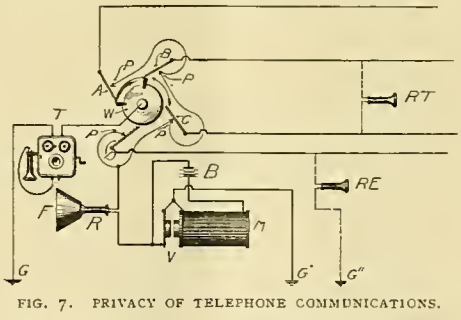


FIG. 7. PRIVACY OF TELEPHONE COMMUNICATIONS.

The operation of the system is as follows: While a message is being transmitted the vibrator (V) is set in action, as is also, of course, the clockwork driving the contact wheel (W). Now, by consulting the diagram, it will be seen that whenever a brush makes contact with the extended portion of the wheel (W), that particular brush ceases to be in contact with the point (P). This is done for the purpose of preventing the production of a noise in the telephone receivers by the magnetic "kick" coming from the make-and-break arrangement (V). With an eavesdropper at (R E), a constant noise is emitted by the loud-speaking receiver (R), by reason of the earth circuit produced through the grounds (G') and (G'') and over the contact (P) of the brush (D). In case no ground had been made, but the (B) and (C) wires connected together instead by the receiver (R T), as shown, a noise would still be the result, for either the (B P) or (C P) contact point would remain in circuit with the vibrator (V) over the earth (G') and the telephone ground (G). Thus, with the above construction, it would appear that a reasonable amount of secrecy could be maintained for messages transmitted over the circuit.

Telephone Service in Michigan.[1]

By J. B. Ware.

The telephone was first brought to the attention of the general public at the Centennial Exposition at Philadelphia in 1876, and as a scientific curiosity attracted much attention. During the next four years it was demonstrated to be of practical value, and the control of the patents necessary to give a monopoly of the invention was secured by a company organized as the American Bell Telephone company, with its main office in Boston—the name Bell being adopted because of the importance of the inventions of Elisha Graham Bell. The parent company decided not to build or operate telephone exchanges, but to promote branch or licensee companies in states or districts, to which the telephones would be leased at large annual royalties and under ironclad contracts that they should not use any other instruments nor do business with any company using other than the Bell company's instruments.

Among these branch or subordinate Bell companies was, and is yet, the Michigan Telephone company, which, while not owning a complete telephone, has for 20 years been doing business in Michigan, and until within about four years has had a complete monopoly of the telephone business of the state. It built exchanges in the cities and larger towns of the state; later it constructed toll lines quite extensively in that portion of the state south of the Flint and Pere Marquette railroad; it made exchange-service rates in Detroit $72 to $120 for business and $50 and upward for residences; in other portions of the state the office telephones averaged over $50 and residence $40, the Grand Rapids rates ranging from $50 to $120 per instrument for business places, the county paying for years $120 for the county-farm telephone; it issued stock to the amount of $2,500,000, which sold at various prices, and for years paid six per cent. dividends upon the same.

It was not until 1894 that, owing to certain important patents having expired, it found itself threatened with competition. Its general officers and exchange managers explained that it was impossible to do business at any greatly reduced rates and have any profits and called attention to the fact that but six per cent. dividends had been paid. These statements, constantly reiterated and being based upon many years' experience, as the Bell company's officials frankly and frequently pointed out, together with the very limited opportunity of buying either exchange apparatus or telephones, did not deter a few parties outside the Bell company from venturing to build exchanges, as was done at Niles by parties residing in Chicago, and at Port Huron by parties living in another city. Thus were started, with inferior material and without local capital or influence, the two leading exchanges in the state previous to the summer of 1895.

In the fall of 1894 certain prominent business men of Grand Rapids made application to the city for a 30-year franchise for telephone-exchange purposes, the same limiting service rates to $36 for business places within a one-mile radius and $24 for residences anywhere in the city, which franchise was granted and formally accepted in January, 1895, and is the franchise under which the Citizens' Telephone company is now operating.

It is worthy of note that, while the Bell company (the Michigan Telephone company) has no franchise anywhere in the state regulating or establishing exchange rates, the Independent companies, with scarcely an exception, have requested and accepted franchises not only regulating the business, but service rates as well, so that without competition in the state the people would continue to receive from the Independent companies practically the same rates as now exist, while the Bell company, being unrestricted as to rates, could advance them, and undoubtedly would do so, as it still claims it is impossible to pay expenses at rates charged by the Independent companies.

Following the date of acceptance of the Grand Rapids franchise by local citizens, the Michigan Telephone company established uniform rates April 1, 1895, in the state, outside Detroit, of $48 for business places within half a mile (with $5 for each additional quarter mile) and $36 for residences, stating that these were the very lowest rates at which exchange service could be given and leave any margin of profits.

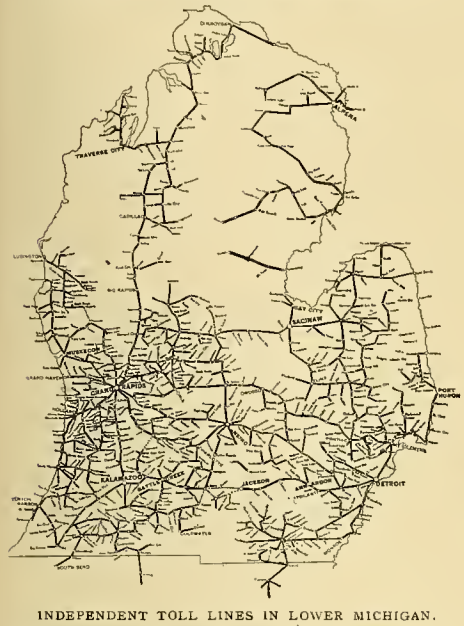
The toll-line service was over inadequate single iron-wire lines, as a rule, and necessarily the service was unsatisfactory and the rates were high; the exchange service was very generally condemned. No improvements were being made, none were promised and the officials of the Bell company constantly assured the public no lower rates could be, nor would be, made.

Up to this time there had been no Independent exchange of over 600 telephones put in successful operation in the United States; the manufacturers

1 From the Michigan Tradesman. Mr. Ware is the secretary of the Citizens' Telephone company of Grand Rapids.

of Independent apparatus had scarcely established themselves, and the Bell company claimed their apparatus was infringing the Bell patents and began numerous suits, none of which proved successful; the American Bell company had paid dividends exceeding $21,000,000 in 10 years preceding 1894, and had over $2,500,000 of surplus; Senator McMillan had for years been president of the Michigan Telephone company and his great political influence was naturally in the interest of the Bell company; practical telephone men of ability and business capacity were unknown outside the Bell company. Yet, in spite of these facts, and many obstacles not named, the Citizens' Telephone company was organized and incorporated, in August, 1895, and plans were made to build an exchange of 1,500 telephones in Grand Rapids.

Rates were established, on three-year contracts, of $30 for business telephones within a mile radius (with $2 for each additional quarter mile) and $20



INDEPENDENT TOLL LINES IN LOWER MICHIGAN.

for residences anywhere within the city limits. Construction was begun October 7, 1895, and service commenced July 1, 1896, with about 800 telephones connected out of nearly 1,600 orders. Because of construction then under way, and conditions incident to such an enterprise, poorer service was given, on the start, than before known in the community, but this gradually changed until, by October 1st, a much improved service was given and about 1,500 telephones were in use. The service of the Citizens' Telephone company, at the present time, is not excelled in the state.

Three months before the Citizens' company began service the Bell company—April 1, 1896—reduced its rates to $24 for business and $18 for residence telephones anywhere in the city. The June, 1896, directory of the Bell company showed it had 1,481 telephones in service. The loss of subscribers to the Bell company was so heavy that in November, 1896, free residence telephones were given to all users of Bell telephones in Grand Rapids and solicitors put out to secure other users on the same terms. This free service was continued nearly or quite two years, during which time the Bell exchange numbered from 1,000 to 1,300 telephones, they having 1,299 telephones on January 1, 1899, per the official report of the Michigan Telephone company for the year ending December 31, 1898.

The constant growth of the Citizens' Telephone company is shown by the following statistics, from its last directory—May, 1899:

Date.	Telephones in service.	State Line tel. phones.	Total
June 1, 1896	400	none.	400
Septmber 1, 1896	1,460	951	2,411
January 1, 1897	1,776	1,628	3,404
May 10, 1897	1,919	1 848	3,767
October 20, 1897	2,074	2,028	4,102
April 22, 1898	2,326	4,382	6,708
November 1, 1898	2,488	5,677	8,165
May 1, 1899	2,841	19.043	21,884

The telephones actually in service in Grand Rapids on August 1, 1899, based on the most reliable figures obtainable, were as follows:

	Business.	Residence.	Total.
Citizen	1,750	1,150	2,900
Bell	600	1,000	1,600
	1,150	150	1,300

The Citizens' Telephone company now owns 14 exchanges, 72 toll stations, over 700 miles of metallic circuit and has over 3,600 telephones of its own in service.

In Muskegon the Citizens' Telephone company began service in October, 1806. It has had a constant and remarkable growth and now has 540 telephones in service. The Bell company's Muskegon exchange numbers less than 150 telephones, and has received no regular exchange-service rentals for 2½ years.

The Twin City Telephone company occupied Benton Harbor and St. Joseph in the fall of 1896, which record is also a remarkably successful one, especially in Benton Harbor, where it has nearly 400 telephones in service, while the Bell company has less than 40—reported to be 12.

Lansing, Kalamazoo, Three Rivers, Allegan, Cadillac, Petoskey and other important towns in Western Michigan have had successful exchanges in operation for two or more years, each with its interesting history. Eastern Michigan has developed the telephone field in a rapid way. The largest exchange in the state, as shown by official figures on January 1, 1899, was that of the Detroit Telephone company, with over 5,200 telephones in operation in Detroit. The Bell company's exchange on that date was 4,704, the largest number in its history. For over two years the Detroit exchange was the largest Independent exchange in the United States, and the writer doubts whether the very successful exchanges in St. Louis, Mo., and Indianapolis, Ind., recently started, have, as yet, more telephones in service.

Inspired by the success of the Detroit exchange, the New State Telephone company was organized to build exchanges and toll lines in territory naturally tributary to Detroit. It has a capital of $1,000,000 and owns a large number of exchanges at Jackson, Ann Arbor, Port Huron, Mount Clemens and other cities, together with a large mileage of state lines. Its main office is in Detroit.

The Valley Telephone company has built exchanges in Saginaw, Bay City and Flint, and in other and smaller cities in its neighborhood, and has about 3,000 telephones in service, with every indication of permanent success.

The Thumb Telephone company has covered the counties of Huron, Tuscola and Sanilac quite fully, having over 400 miles of circuits, and is making many improvements.

The Union Telephone company is one of the latest organized, with main office at Alma. It is connecting the Saginaw district with the Citizens' system and expects to occupy the interior territory.

One of the strongest companies in the state is the Central Telephone company of Kalamazoo, which has covered the southwestern portion with fine copper toll lines and is managed in a businesslike way that insures success. Besides these there are other companies of lesser size, but of great importance, in various parts of the state, of which time does not permit details. The Alpena movement and the upper peninsula companies have accomplished much and deserve more space than the writer commands. It can be said, briefly, that in the upper peninsula the Independents have over 3,000 telephones in service, believed to be more than has the Bell company in the same field. There are no toll lines in the upper peninsula connecting the different sections together.

The Independent long-distance companies of Ohio and Indiana will make it possible within a very few months for the exchanges in lower Michigan to talk to points north of the Ohio River between Pittsburg and St. Louis. Already Fort Wayne and other interstate points are reached by copper long-distance circuits.

In the state the Michigan Telephone company (Bell) had 76 exchanges, with 10 or more telephones in each, and 19,539 telephones on January 1, 1899, per official statement. The Independents have in the state over 180 exchanges—in three years!—with more than 30,000 telephones in service.

Although the Michigan Telephone company on July 1st issued a fine state directory, the duplication of names for the convenience of its patrons makes it difficult to ascertain the number of telephones it actually has in service. Thus, in Detroit appears Richmond & Backus company, with 10 names of individuals or departments, although the firm has but two Bell telephones in service. In Allegan, with but two telephones, the Bell book shows ten names of county offices, etc., so that "the names of about 30,000 subscribers" represent about 22,000 telephones in actual service at this time.

Besides surpassing the Bell company in numbers of telephones and exchanges, the Independents have more copper circuits, more miles of wire and have about 200 more toll stations than does the Michigan Telephone company. The map of the Independent

[*Continued on page 192.*]

NEW COMPANIES.

The Scranton and Stroudsburg Telephone company of Scranton, Pa., has been incorporated, with a capital stock of $10,000.

The Union Telephone company of Keyser, W. Va., with authorized capital of $50.000, has been incorporated by C. W. Siever and others.

The International Telephone and Switchboard company, with an authorized capital of $1.000.000, has filed papers of incorporation in New Jersey. The company is to make telephones and switchboards, and the corporators are L. B. Grant, Thomas S. White, New York, and J. C. Pope of Plainfield, N. J.

The United Electric Construction company has been organized at Kittery, Me., for the purpose of operating telephone lines between Westfield and Fairfield, Mass., and other points, with $200.000 capital stock. The officers are: President, Henry E. Roberts of Medford Hillside, Mass.; treasurer, George B. Perkins of Medford, Mass.

The New Telephone Incorporation of the City of New York and State of New York is the title of a concern which was incorporated at Albany on September 21st. It proposes to construct and maintain a line of telephone and telegraph in New York city and all the principal cities, villages and towns in the state, including Albany, Troy, Utica, Syracuse, Rochester and Buffalo. The capital is $10,000, and the directors include William G. Conklin, Edward Ashfort, Z. Melville Knowles and others of New York city.

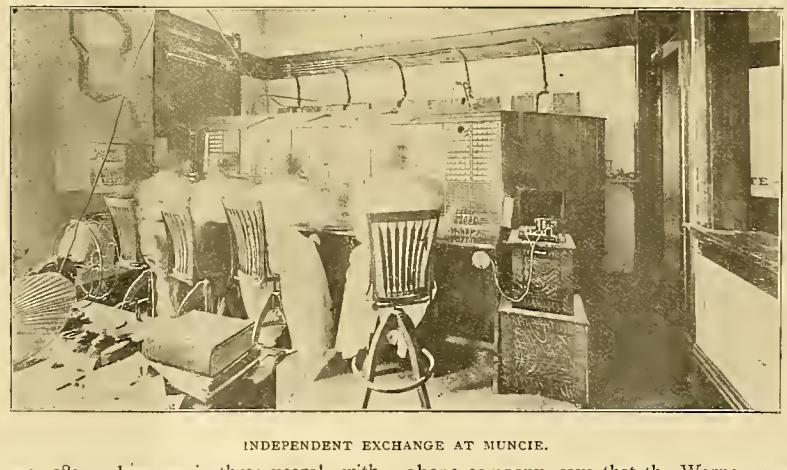
Independent Exchange at Muncie.

Muncie, Ind., with its 13.000 inhabitants, has a Bell exchange and also an Independent company with about 500 subscribers. The latter has been lately reorganized and is now in strong hands and is one of the most progressive of the Independent companies in Indiana.

The accompanying illustration shows the five-section switchboard of the Independent company at Muncie. This board was built by the Electric Appliance company of Chicago and has been in use for over two years. The outside construction of the company is excellent.

Prominently shown in the picture, at the right of the switchboard, is a Warner telephone generator, made by the W. F. Warner company of Muncie, Ind. This is a power generator, operated by primary batteries, and furnishes the current for signaling subscribers. The machine sets on top of the cabinet, which is made in two compartments. In the upper and small part is located the special type closed-circuit battery, which is used to keep the vibrator in motion, and in the larger part at the bottom are packed the dry cells which furnish the power for signaling. An iron cover protects the machine from dust, and the whole outfit is mounted on rollers and can be moved easily, weighing about 190 pounds and occupying a space 38 inches high and 16 by 18 inches in area.

Mr. Palmer, the manager of the Muncie Telephone company, says that the Warner generator in his exchange has been running continuously for over six months without taking a moment for changes or repairs. He thinks that it is the cheapest method of obtaining power for signaling subscribers. The Warner telephone generator is used by both Bell and Independent companies, it is said.



INDEPENDENT EXCHANGE AT MUNCIE.

MANUFACTURERS AND DEALERS.

The Telephone Manufacturing company of Sumter, S. C., will erect a new factory.

The Interstate Telephone company will, it is said, establish a factory at Durham, N. C., for the manufacture of telephones.

The Sterling Electric company of Chicago has just contracted to furnish the Tippecanoe Telephone company a new switchboard and office arresters, to replace the apparatus heretofore in use.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CIRCULATION, 20,000.

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When last heard from, Mr. and Mrs. Davis, who started to ride from New York to San Francisco in a gasoline vehicle, were somewhere in the neighborhood of Adrian, Mich. The latest news from these plucky but ill-starred travelers was as discouraging as the first. A farmer had been employed to haul the machine to Adrian, where it went into shop for inspection and general repairs. The last recorded speed made by the automobile was 12 miles in four days. The Chicago Tribune thinks that if Mr. and Mrs. Davis have any serious intention of going to California they will get there more quickly and easily by walking. The venture has certainly been most unfortunate, for the start from New York was made on July 13th.

Mr. Ware makes a strong showing for the Independent companies in Michigan in his article, reprinted in another place in this issue. He shows what they have done for the telephone users of that state, and his straightforward statement, based on carefully prepared statistics, will gratify every friend of the movement. In particular, the company with which Mr. Ware is connected is to be congratulated on the notable success it has achieved in Grand Rapids.

General Brooke having been directed by the United States government to prevent the landing of a cable in Cuba to compete with the Western Union company, which claims exclusive contract rights, the Commercial Cable company is much exercised and is decrying monopoly. Public sympathy with the Commercial people would be greater, if, in operating their land lines, they were not at one with the Western Union company in maintaining a monopoly of prices. Existing telegraph tolls in the United States are high, and as there is no competition in rates, the Postal-Commercial company cannot raise the monopoly cry with very good grace.

It is pleasing to learn, from a late dispatch from General Otis, that the United States cable ship Hooker, which was considered a total loss, is certain to be saved. The Hooker went ashore on Corregidor Island, at the mouth of Manila Bay. General Otis says that arrangements have been made for getting the Hooker off the rocks and taking her to Cavité arsenal, where she will receive repairs sufficient to permit her to go to Hongkong to be thoroughly overhauled and put in first-class condition. It was rather humiliating that the first cable ship to be fitted out by the government as a consequence of the over-sea expansion of the United States should be run on the rocks. But, of course, the fault, if there was a fault, was that of the navigator in charge, and not of the electrical men. The Hooker is a refitted ship that was captured from the Spanish during the war; but it is to be hoped that its evil days are now over, and that after leaving dock at Hongkong it will have a long and useful career.

By inviting bids for the construction of a new wheel-pit the Niagara Power company gives indubitable evidence of the entire success of the great plant for the electrical conversion and transmission of power from Niagara Falls. The present wheel-pit is now, or shortly will be, utilized to its full capacity of 50,000 horse power, and the new pit will double this capacity. An electrical generating plant of 100,000 horse power is of tremendous size, greater than any steam-driven electrical plant in the world at the present time—perhaps larger than any other single steam or water-power plant of any character. The courage and foresight of the founders have been justified by experience and will no doubt be financially rewarded. Certainly the prospects for the latter must be excellent, or the large expense of doubling the great plant (with the exception of the inlet canal and tunnel) would not be undertaken. The whole enterprise is of the utmost interest and significance as an industrial development.

Liquid air may go hang! Electricity in capsules, for the vest pocket, is now the proper caper in power development. There is an inventor, a $15,000,000 company with an office on Wall street, a few shares of stock to sell, mention of the discovery in the newspapers, and all the other adjuncts of a grand and glorious discovery to ease the burden of the toiler and lift the shadow from the brow of the oppressed. Hereafter every man can carry around enough electricity on his person, in capsules, to run a planing-mill, and the world will be the better for it. The citizen, by providing himself with a few capsules (sold in pasteboard boxes, by the dozen or gross, by all grocers and dealers in notions), may become his own electric-light plant or he can run an automobile from New York to San Francisco. The cost will be somewhat cheaper than for the same amount of quinine and will be about the same as for a similar quantity of calomel. Being electricity, the capsules are very exhilarating, and, when taken internally, they are a specific for chilblains, mumps and that tired feeling. They contain a wonderful white powder, that, for power generation, is simply dissolved in water, making a battery solution in which no copper is necessary. The capsule electricity is cheap, too, as light can be produced at less than one-fifth of a mill per lamp-hour, or about one-twenty-fifth of the present cost. Not the slightest knowledge of the old electricity is necessary for the user of the new kind, and the tabules will keep for years in any kind of climate without losing strength. Children cry for the capsules, and no family should be without them, for if they are once used they will be always used.

Further details of this remarkable invention are to be found in the New York papers. The Brooklyn Eagle of September 22d had about a column about it.

At the recent banquet of the Association of Edison Illuminating Companies in Philadelphia, Col. Eugene Griffin spoke of the part played by electrical engineers during the late war with Spain. He noted that many engineering officers in the United States navy had spoken to him in appreciation of the work done by the volunteers who came forward to assist in laying submarine mines for the protection of the harbors along the eastern coast and in erecting apparatus on land which required electrical skill. The suggestion originally came, he said, from Mr. Caryl D. Haskins of Boston. Colonel Griffin made the point that there was nothing strange in the efficiency of the volunteer engineers, because in this case it was the army engineers who had been the amateurs, while the volunteer electricians had been the professionals, being accustomed to handle currents of much higher potential and to lay cables under water as their daily work. Modern warfare makes necessary the employment of the training of the electrical engineer and the skill of the electrician, and it is pleasing to realize that American electrical men, although trained in the arts of peace, can readily turn their talents and experience into effective expression for the national honor or the national defense.

One of the most active of the municipal-ownership men at the convention of the League of American Municipalities in Syracuse last week was Mayor Johnson of Denver, who was elected president of the organization. He made the opening address in favor of his pet panacea and advocated municipal ownership of waterworks, gas and electric lighting, street-car lines and telephone service. In addition, steam heat from the municipal electric stations, which the mayor confidently states is a by-product that is "free of extra cost and which, if properly used, is capable of heating all buildings in a radius of one-half mile," is to be furnished at small cost to great public wash-houses.

This is an ambitious programme, and it is supported by the usual arguments. It is interesting to note that in discussing the telephone situation Mayor Johnson seems moved to advocate municipal ownership principally because of the rapacity of the Bell companies. Thus: "In Denver 2,500 telephones are in use. For an unlimited service the charge for a telephone for a year is $120. Indianapolis, with about the same population, has two systems. The New Telephone company, with a better system than Denver, charges only $40 a telephone a year in a business house and only $24 a year for residences. Both are full, unlimited, up-to-date systems, as good as can be had. This New company is doing a fine business and making a handsome profit. If this be true, by what name shall we style the company which charges the people of its own city three times as much as is necessary to make a handsome profit?"

Mayor Johnson admits that a private telephone company in a city, even with exorbitant charges, is far better than no telephone system. Why, then, propose municipal ownership to wipe out the new-founded enterprises of the Independents, who are asking only fair and reasonable prices? Why should the new Independent companies suffer for the misdoings of the old Bell companies? But it is very unlikely that the cities of the United States will ever engage in the general telephone business. Government ownership in the telephone business, as well as in telegraphy, must be accomplished through the medium of the United States government or not at all. Cities might perhaps own or lease a general subway system for all buried wires and pipes, but that will probably be the nearest approach they will make to telephone operation for subscribers.

Marconi in New York.

[Correspondence of the Western Electrician.]

To make space-signaling tests for the military and naval authorities of the United States, and also in pursuance of his agreement with the New York Herald to report the coming international yacht races from a vessel to the shore by his system of wireless telegraphy, Signor Guglielmo Marconi arrived in New York on Thursday of last week, September 21st. Signor Marconi crossed from Liverpool in the Cunard Line steamer Aurania, and reached the city about noon.

For some reason all experimenters, as far as is known, who have operated with wireless telegraphy on this side of the water, have only been partly successful in telegraphing distances over a few miles, and in many cases the operators do not hesitate to admit that high buildings and other structures, that are inevitable in every large city, interfere greatly with the tests. It is not unreasonable, then, to anticipate that Marconi's expositions here will give valuable hints in the right direction.

On the Aurania's passenger-list Signor Marconi was registered as "Mr." As he stepped down the gangway on leaving the steamer, enveloped in a huge brown mackintosh and wearing a brown felt hat, few persons recognized him. He was accompanied by Mr. William Goodbody, one of the London directors of the Wireless Telegraph company, and by Charles E. Rickard, W. W. Bradfield and William Densham, skilled wireless-telegraphy operators, who have been engaged in the experiments in the English Channel, and who will be in charge of the instruments and send the messages to the Herald during the yacht races. On the Aurania also came the apparatus which will be used—transmitters, receivers, batteries, etc.; all the appliances of a telegraph outfit with the exception of wires.

Signor Marconi was greeted by Capt. George Owen Squier, a personal friend, and Capt. Leonard Delacour Wildman, both of the United States Signal Corps, stationed at Governor's Island. To them Signor Marconi explained that half of his luggage, including some of his apparatus, had been misdirected and shipped to Boston, and that he hardly knew what he had with him and what had gone astray. He expressed himself as anxious to know just what was going to be done with his paraphernalia by the custom-house inspectors. The officers explained to him that it had been arranged with the authorities at Washington that all instruments that he had brought over for use in the experiments before the Board of Army Officers would be admitted free of duty, but that any other apparatus, to be used in private tests, would be held dutiable.

A representative of the Western Electrician called upon Signor Marconi at the Hoffman House late Thursday afternoon and was received with every courtesy.

Although Italian on his father's side and by birth, Marconi's mother was an Englishwoman, and in general appearance, complexion and manner the inventor is seemingly a young and clear-complexioned Englishman. Signor Marconi is a man of medium height and slender, with blue eyes and clean-shaven face, except for a slight mustache. He is of a retiring disposition. As might be expected, he speaks English like a native. The Herald described him most aptly: "Signor Marconi looks the student all over and possesses the peculiar semi-abstracted air that characterizes men who devote their days to study and scientific experiment."

Mr. Marconi is apparently besieged by American newspaper men. When your correspondent paid his respects and waited for admittance there was already "a man behind a pad" in the room. And hardly had the writer entered before "No. 3" knocked at the door.

So much has already been published as to the details of Marconi's work that no attempt was made to "interview" him in the strict sense of the word. The most important observation made by the newcomer was to the effect that the curvature of the earth has been discounted. "We have telegraphed 70 miles with the height of the vertical wire 128 feet, and your geometry will tell you that the curvature is about 800 feet."

Speaking of his recent experiments, Marconi said: "Another thing we have found out is that mountains, high buildings, steel masts, etc., do not stop communication. We were able, while in Bantry Bay, to talk with a ship lying many miles from us and separated by a chain of hills hundreds of feet high. The message radiated in all directions and was caught by the pole on the other ship. Again, a very valuable point is that fog does not interfere with a wireless-telegraphic message at all. In fact, at times the instruments have appeared to work better in thick weather. With a pole sufficiently high, a message can practically be sent any distance. There was some talk of my attempting to communicate between New York and Chicago, but I do not think I shall make that experiment. I may, however, try it."

The big steamer Ponce, upon which Signor Marconi will probably direct the reporting of the yacht races, is now at her pier, in Brooklyn. The wireless-telegraphic apparatus will be installed in a few days and tests made before the races to insure perfect working. On board the Grande Duchesse preparations for putting the instruments and pole in place have been begun, under the direction of Mr. W. J. Clarke. When she arrives from Boston everything will be in readiness. From both these fast steamers, as they follow the races, wireless telegraphy will send the story of the contest. It is as yet unsettled whether the space-telegraph messages will be received at the Herald office in Herald square, or whether they will be first taken on receivers stationed at, say, Rockaway, and thence repeated to the Herald office over an ordinary land line. F. L. P.

Divers Experiments in Space Telegraphy.

Under the direction of the faculty, the electrical students of the Armour Institute of Technology in Chicago are arranging a series of space-telegraphy tests between the Institute building at Armour avenue and Thirty-third street and a tug on Lake Michigan, the distance being two miles or more.

A Pittsburg dispatch states that Prof. Reginald A. Fessenden of the Western University of Pennsylvania has demonstrated that his wireless-telegraphy invention will work at long distances. It varies in many details, it is said, from Marconi's. He will use it, by invitation, it is added, at the coming international races in New York.

Dr. Peter Stiens, the Russian who proposes to make the blind see and the deaf hear by electrical communication with the optic and auditory nerves, also offers a few ideas on wireless telephony and telegraphy. A London interviewer reports that the enterprising doctor expressed himself in the following terms: "I am not working on the Hertzian waves at all. My principle is that of using only one means of conduction, namely, the earth. I simply send electricity through the earth from one apparatus to another in sympathy with it. No high poles, nor balloons, nor anything of the kind are required for my system. My apparatus is small and portable. I contend that by my invention not only taps, but spoken words and the sound of the human voice can be heard, and that at great distances."

G. H. Smith, a young workman in a tin-plate factory at Cardiff, Wales, claims to have invented an improvement on Marconi's system of electrical transmission through space. He asserts that he has made a better transmitter than Marconi, a more sensitive receiver and a method of focusing rays so that they can only be picked up by one receiver and cannot be intercepted. "I dispense entirely with the high vertical wire," he is reported to have said, "and guide and focus the electrical waves so they have a width of only one inch in passing, thus making it impossible to intercept them, unless, indeed, a ship could poise its receiver in the particular inch of space through which the rays pass. I am convinced I can telegraph or telephone up to 150 miles. My apparatus can be put on a table or anywhere else and can send a message through a window or wall. It can be worked through the Wheatstone machine up to 500 words a minute."

Warren S. Johnson and C. E. Fortier of Milwaukee have been making successful tests with wireless telegraphy on a system said to be entirely different from that of Marconi. Mr. Johnson is thus reported: "With the instruments we have I could send the steamer Virginia to sea, steer her about in the lake and bring her back to port without the aid of any other agency. I mean that there need not be a person on the boat except some men to shovel coal into the furnaces, and we would do the work of navigating the steamer with the aid of the wireless telegraph with other apparatus attached. Of course, with our present development of the system of wireless telegraphy we would be limited in our management of the vessel by distance. It is a mistake to suppose that wireless telegraphy will ever supplant the other, in which wire plays so important a part. I believe, however, the day will come when vessels navigating in the ocean and the lakes will be required by law to be equipped with the apparatus, and that by means of it they will be able to communicate at all times with the shore and with other vessels on the ocean."

From Colorado Springs comes news that Tesla is not asleep. He has just begun his work, but he did not succeed in concealing himself from the newspaper correspondent. "Two objects brought me here," said the inventor, according to the account. "First, to develop, perfect and manufacture a machine for transmitting messages to Paris next year without the use of wires; second, to work out a theory on which I have been experimenting for five or six years, that there are electrical currents in the strata of air at various altitudes, from which tremendous power can be generated. Some years ago I discovered the principle that power can be transmitted to any distance without wires. The transmission of messages followed close after. Then I discovered a principle to be made of more service. I am only at the beginning, but I was never more confident of success. I never fail." Tesla has an experiment station just east of Colorado City. He seems to expect to talk to Paris next year without the aid of wires. He hopes also to perfect inventions for general use in wireless telegraphy.

A foot-wide miniature electric trolley road girdles the buildings of the Export Exposition at Philadelphia and is used to provide amusement and entertainment for children.

Section of Physics, A. A. A. S.

At the recent meeting in Columbus, O., of the American Association for the Advancement of Science the sessions of the section of physics were distinguished by the high average merit of the papers rather than by any one or two especially remarkable productions. The attendance was very satisfactory as to numbers and principally consisted of those actually at work in some branch of physics. This fact appeared in the unusually satisfactory discussions which followed many of the papers.

Professor F. C. Caldwell of Columbus presented an interesting and efficient method for the study of varying conditions in a rotary converter. He had constructed a set of diagrams, which, when placed under a disk, with appropriate slits and scales, enabled the observer to determine the current and electromotive force in the various coils, at any moment, under varying conditions.

The important subject of the efficiency of gas and oil engines is attracting particular attention at present, and the paper by Professor H. T. Eddy of Minneapolis was a welcome contribution to the subject. He presents a simple, graphical method for constructing the entrophy-temperature diagram from the indicator card, and points out that these diagrams are particularly valuable in detecting the weak points of any particular engine.

Mr. L. J. Briggs of Washington has constructed a convenient electrical condenser of variable capacity, by piling up a series of alternating plates of brass and mica and compressing the system more or less by means of a thumb-screw.

Professor J. McK. Cattell of New York, in his observation that the time of perception is a measure of the relative intensity of illumination of two surfaces, has furnished an important contribution to the subject of photometry. He finds that the time required to decide which of two surfaces is the darker is a direct measure of the difference of the two surfaces. When one stops to realize that we recognize our surroundings as stationary, and as individual objects, in spite of the motions of the eye and head, whereas the spokes of a moving wheel and similar objects lose their identity and appear blurred, we can appreciate the importance of Professor Cattell's investigations upon this subject. He finds that within certain limits of speed, when the motion of the images upon the retina of the eye is produced by a motion of the head or eye, a blending does not occur, but if the eye is stationary and the object moves, blurring takes place. This would lead to the inevitable conclusion that the operation of vision is seated more in the brain, and less in the retina, than is usually assumed. Incidentally, it shows that our vision has, by the process of evolution, developed so as to be most useful and effective for us, just as any other function of the body.

Professor E. W. Scripture of New Haven finds that an alternating electric current, if the alternations are slow, produces muscular contraction; on the other hand, as the rate of alternation approaches 5,000 per second, the muscular contraction in most cases disappears and an insensibility to pain in the region affected takes place. This method of anesthesia or analgesia promises to be of considerable utility for local application, as, for example, in dentistry and the surgery of the extremities.

Doctors H. S. Carhart and K. E. Guthe of the University of Michigan presented the value 1.4333 volts at 15° Centigrade as the result of their absolute determination of the electromotive force of the standard Clark cell.

The investigation of the coherer made by Dr. Augustus Trowbridge of New Haven is an important contribution to the subject of wireless telegraphy. He finds that a certain minimum electromotive force of from eight to 10 volts is necessary to break down the resistance of any particular coherer, and that electrical impulses, after the first have practically no beneficial effect. It thus appears unnecessary that the disturbance should be oscillatory, as the first wave would produce all the effect. This observation explains much of the erratic behavior of coherers in experimental use.

Professor Reginald A. Fessenden of Allegheny, Pa., presented a number of interesting papers upon magnetic and electric subjects; he also described and explained several new pieces of electrical apparatus. Two papers dealt with the intricate problem of the factors affecting the resistance, capacity and polarization in the electrolytic cell.

Dr. F. A. Wolff, Jr., of Washington, D. C., presented to the section an interesting account of the progress that has been made in providing this country with a national laboratory in which electrical apparatus can be tested and standardized. He reports that in the office of the United States Standard Weights and Measures facilities are now available for the testing of most of the ordinary electrical apparatus, and that many obstacles had to be surmounted, but the progress is extremely encouraging.

A number of articles were read upon optical subjects, which are of interest, particularly in the theoretical discussions of such phenomena, and of less practical importance.

Perhaps the most suggestive paper was that by Professor Fessenden on the nature of electricity and magnetism and certain constants of the ether. After pointing out the great value of dimensional formulæ in the discussion of physical problems, he took up the question of the fundamental relations between certain optical properties and certain electromagnetic properties of the ether, pointing out

that we have three formulæ for the relation between four quantities, and consequently, cannot solve the equations in the ordinary method. It is necessary to obtain some fourth relation between these quantities, and by a discussion of the dimensions of the quantities involved it becomes possible to make certain hypotheses; two of these are shown to be the most probable, and then experimental observations are called in to determine which of these is preferable. A large mass of experimental observations as to the relation between permeability, density, specific inductive capacity and certain optical constants of a long list of substances leads to a choice between the two possible formulæ. From this conclusion it is possible to deduce values for the elasticity of the ether, as well as its density, and also, by constructing the dimensional formulæ for the magnetic quantities, it is possible to visualize the nature of the magnetic quantities. It is hoped that this paper will appear in full in Science, and the reader must be referred to its full publication for further details. The mass of evidence is much too great to be presented in a brief review.

Dr. O. L. Fassig of Baltimore gave an important generalization upon the weather on the Atlantic coast, as influenced by certain areas of persistent high barometer. His conclusions will go far toward raising long-distance weather predictions from mere guesswork to scientific conclusions. The paper will appear in the American Journal of Science

The old war between armor and guns is likely to have its counterpart in a new struggle between smokeless powder and the means for locating its flashes. Professor Fessenden has contributed the first article on the defensive side, by showing that by the simple use of a red color screen the flash becomes quite readily distinguishable. The flash of smokeless powder proves to be essentially red, whereas the diffused light coming from the landscape at large is very weak in the red, consequently, when a red screen is used, the illumination of the general landscape is greatly reduced, whereas the gun flash appears with undiminished brightness. The contrast becomes sufficient to enable the observer to readily locate the flash.

Professor Thomas Gray of Terre Haute, Ind., gave some additional observations on the dielectric strength of oils, pointing out the rather peculiar fact that the strength per centimeter decreases as the thickness of the layer increases. These observations were made between spherical terminals. He also called attention to certain errors which might arise in wattmeters, owing to the absorption of moisture by the surroundings of the resistance coils, and to others due to capacity conditions in the fine-wire coil.

In addition to the papers mentioned above, the following-named were presented to the section of physics: "Compound Harmonic Vibration of a String," W. Hallock, New York, N. Y.; "The Musical Scales of the Arabs," Charles K. Wead, Washington, D. C.; "Medieval Organ Pipes and Their Bearing on the History of the Scale," Charles K. Wead, Washington, D. C.; "Polarization and Polarization Capacity of an Electrolytic Cell," K. E. Guthe and M. D. Atkins, Ann Arbor, Mich.; "Polarization and Internal Resistance of the Copper Voltameter," B. E. Moore, Lincoln, Neb.; "Concerning the Fall of Potential at the Anode in a Geissler Tube," C. A. Skinner, Lincoln, Neb.; "An Experimental Test of the Accuracy of Ohm's Law," F. A. Wolff, Jr., Washington, D. C.; "A New Spectrophotometer and a Method of Optically Calibrating the Slit," D. B. Brace, Lincoln, Neb.; "On Achromatic Polarization in Crystalline Combinations," D. B. Brace, Lincoln, Neb.; "A Method for the Study of Phosphorescent Sulphides," Fred. E. Kester, Columbus, O.; "Accidental Double Refraction in Colloids and Crystalloids," B. V. Hill, Lincoln, Neb.; "Note on the Age of the Earth," Reginald A. Fessenden, Allegheny, Pa.; "A Barometric Study of the Radiations of a Black Body Between 600° Centigrade and 1,100° Centigrade," C. E. Mendenhall, Williamstown, Mass.; "A Barometric Study of the Radiations of an Absolute Black Body," F. A. Saunders, Haverford, Pa.; "On the Escape of Gases from the Plants, According to the Kinetic Theory," S. E. Cook, Lincoln, Neb.; "On Differential Dispersion in Double Refracting Media," E. J. Rendtorff, Lincoln, Neb.; "Relation of Magnetization to the Modulus of Elasticity," J. S. Stevens, Orono, Me.; "On Flutings in the Kundt Sound Tube," S. B. Cook, Lincoln, Neb.; "Some Unexpected Errors in Wattmeter Measurements," Thomas Gray, Terre Haute, Ind.; "Optical Calibration of the Slit of a Spectrometer," E. V. Capps, Lincoln, Neb.

Competition Lively in Indiana.

The Bell Telephone company, having about completed its copper-metallic long-distance line between Wabash, Ind., and Goshen, has announced a cut of almost one-half in the rates charged by the Independent toll lines between the competing points. Where the Independent rate has been 25 cents, the Bell rate is 15 cents. The Independent lines will at once meet the cut, and south of Wabash, where the Bell has a monopoly of toll service, the Independents are pushing construction, and will reduce rates to half those charged by the Bell. Between non-competing points the Bell maintains its tariff.

H. R. Lyon has been granted a franchise at Mandan, N. D., for an electric-light plant.

Telephone Service in Michigan.

[*Continued from page 189.*]

lines, published on page 189, indicates a more thorough covering of the state by the Independent lines; but the magnitude of the growth is perhaps best shown by the following list of places where the Independents have exchanges as indicated, but the Bell company has but one telephone in each, unless otherwise shown:

	Bell.	Cit.		Bell.	Cit.
Allegan	1	146	Middleville	1	40
Athens	1	19	Montague	1	17
Bangor	1	23	Muir	1	21
Bellville	1	20	Mulliken	1	18
Bellevue	1	31	Nashville	5	46
Birmingham	1	20	Newaygo	1	19
Cadillac	4	106	North Branch	1	16
Carson City	1	11	Northville	1	60
Casnovia	1	12	Orion	2	20
Coopersville	1	22	Otsego	2	93
Cassopolis	1	111	Oxford	1	41
Cedar Springs	1	43	Paw Paw	1	60
Coral	1	10	Pentwater	1	14
Decatur	1	23	Plymouth	1	26
Douglas	0	16	Reed City	2	64
Dowagiac	4	280	Rochester	5	30
Edmore	1	12	Rockford	1	43
Evart	1	43	Romeo	9	40
Fennville	0	39	St Johns	5	129
Flushing	1	80	Sand Hill	1	45
Fremont	1	42	Saranac	1	41
Grapes	0	40	Saugatuck	0	31
Hart	1	59	Shelby	1	28
Hartford	1	35	Sheridao	1	12
Holly	5	50	Sparta	1	18
Howard City	1	78	South Haveo	1	179
Imay City	1	31	Stanton	2	67
Ithaca	1	90	Sturgis	3	125
Kalkaskia	0	84	Tre ton	1	12
Lake Odessa	1	30	Utica	1	27
Lakeview	1	17	Vermontville	1	23
Lawton	1	30	Vicksburg	1	31
Leslie	1	21	Watervliet	0	33
Lyons	1	25	Wayland	1	32
Manton	1	20	Whitehall	1	16
Maple Rapids	1	11	Zeeland	1	31
Marcellus	3	42			
Marine City	1	96	74 places	106	3,400
Mendon	1	27			

The above list is far from being complete, as the writer has not sufficient information from certain portions of the state to give more figures, but it is sufficient to indicate the trend of the telephone movement. In other words, the Independents, in less than four years, have more exchanges in cities and towns where the Bell company, after 20 years, has no exchanges than the total Bell company exchanges in the entire state, they having over twice as many exchanges as the Michigan Telephone company.

It is but fair to state that in the great majority of cases the Independent companies are improving their property and are in all cases giving better service than was given before these companies began service; that the rates for exchange and toll service, while, perhaps, on an average scarcely half the former Michigan Telephone company's rates, in a very large majority of cases enable the paying of dividends satisfactory to the average business man, and many of the companies are so doing. While it is true that in a few cases Independent rates have been made too low, as a rule they can be maintained permanently, unless by reason of excessive growth of exchanges. The Michigan Telephone company is making service rates below cost in many cities and towns in the state where it has competition, and in Grand Rapids, Muskegon, Benton Harbor, etc., has not had, for over two years, sufficient telephone rentals to pay expenses of operation, not including interest on any portion of the $5,285,000 mortgage bonds authorized, over half being issued; nor does the Bell company claim to be able to pay expenses of operation at the various rates it now charges.

These Bell rates vary in different localities, apparently without rhyme or reason, as is shown by the few following:

	Bus.	Res.		Bus.	Res.
Grand Rapids	$24	$12	Big Rapids	$24	$12
Kalamazoo	24	12		18	
Charlotte	24	6	Port Huron	24	18
Lowell	12	6	Mt. Clemens	18	16
Detroit	40	24	Holland	12	12
Alpena	6	3			

It is impossible for the Michigan Bell company permanently to do business at a loss. By less than cost rates, temporarily, it hopes to undermine Independent companies by forcing them to ruinous rates or creating in the public mind the idea that the Independent rates are too high, and thus they think to divide public support and destroy competition. Where neither plan works it is proposed to purchase companies holding strong geographical positions, judging from the actions of the Bell officials in other territory in which they operate.

Besides the phenomenal growth of the Independent movement, its hearty support by the citizens of the state generally, and by certain communities especially, makes a sell-out to the Bell company an act of treachery to the business community; and no individual company or exchange can so sell without the loss of business honor to the officers and directors who should consent to such a step.

The Independent movement in Michigan has resulted thus far in the following: 1. Lower rates for both exchange and toll service. 2. Better service for exchange and toll lines. 3. More telephones in use and greater use of telephones. 4. Greater consideration of telephone users. And, because it is in the interest of all the people of the state, it will continue to grow and prosper, until through it every community in the state—business, manufacturing, farming, fruit growing, all—will have permanently good telephone service at reasonable rates and managed by citizens of the state. Never again will the old rates be restored or the old company be given control of the situation, for telephone liberty and prosperity are too sweet and too valuable to be surrendered to any foreign corporation.

Telephone Patents of James G. Nolen.

James G. Nolen, a well-known Chicago telephone man, has been granted patents, under date of September 19th, for a combined generator and ringer for telephones and for a tablet and index. The latter patent relates to a series of metallic tablet-holders, which can be attached to a telephone generator-box and arranged to hold a printed index of telephone subscribers. The first-named invention relates particularly to a novel combination of some of the telephone parts. One of the essential objects of the invention is so to arrange and combine the generator and ringer mechanisms that the usual polarizing magnet employed for the fields of the ringer mechanism, together with a number of contacts and connections that heretofore have been necessary, will be entirely dispensed with. Another object is to provide means so that the strength of the polarizing magnet may be increased or diminished as may be desired. With these objects in view the invention consists, broadly, in so combining the generator and ringer mechanisms as to permit of the utilization of the field magnet or magnets of the generator as the polarizing magnet for the fields of the ringer. An advantage is thus claimed by the inventor over the old method of having the fields of the generator surrounding the coils, as it gives a great retadation, and it is said, for bridge work, will prevent voice currents from crossing the bridge.

Illinois Telephone Company.

The men interested in the Illinois Telephone and Telegraph company assert that already the company has applications for service equaling the number of subscribers to the Chicago Telephone company. The city authorities have decided to grant the new company's application to build conduits under the streets. Mr. McGann, the commissioner of public works, has notified the company that the permits will be issued to accord with the company's specifications. However, the commissioner makes these reservations: "Said permits will be issued with the express understanding that any duly authorized employe of the city of Chicago shall be permitted by your company to enter your conduits at any time for the purpose of doing any work necessary for the construction and maintenance or the making of any alterations or repairs of the wires used by the city of Chicago, in accordance with the provisions of the said ordinance of February 20, 1899, and said permits will be issued on the further express understanding that the conduits constructed and maintained by your company under said ordinance will be used for no other purpose than the stringing of wires for telegraph and telephone service only."

War Tax on Telephone Messages.

Mr. Treat, collector of internal revenue at New York, has notified the New York Telephone company that it must furnish a sworn statement of the number of messages sent, under the contract of 600 messages for $60, between July 1, 1898, and May 1, 1899. This is to enforce the war tax of a cent a message which the company tried to evade, appealing to Commissioner of Internal Revenue Wilson at Washington, who returned the following ruling to Mr. Treat: "You are advised that this office holds that on each of the messages sent under the 600-messages-for-$60 contract a tax of one cent should be imposed, and you are directed to request the New York Telephone company to furnish you with a sworn statement of messages sent under this form of contract and report the same to this office." Soon after the war tax was levied the company reduced its tolls from 15 to 10 cents a message. Later the price on private lines was reduced from $90 to $60 for 600 messages. If, however, the subscriber sent less than the allowed 600 the rate is brought under the war-tax law. It is on this point, says the New York Sun, that the late ruling was made. The amount due the government is considerably more than $5,000.

EXTENSIONS AND IMPROVEMENTS.

Arrangements have been completed for the construction of a telephone system from Lexington to Lynchburg, Va., by the Lexington Telephone company and the Lynchburg Telephone company.

The Independent Telephone company of Yates Center, Kan., has completed its exchange, beginning with 70 subscribers. It expects to connect with the new company at Fredonia in a short time.

A new North Side exchange office will be built by the Chicago Telephone company at 273 East Chicago avenue next spring. The building is to be a two-story brick structure, and will cost $70,000. The present offices at Clark street and Chicago avenue will be moved into it.

The Michigan Telephone company says it is behind its orders in installing new telephones and has decided to erect another new telephone exchange, work to be begun next month. General Manager Forbes says that within the state the company is from 3,000 to 5,000 telephones behind its orders.

New Theater Dimmers.

There has been lately placed upon the market by the Ironclad Resistance company of Westfield, N. J., a line of theater dimmers, which the company asserts to be the embodiment of the latest developments in that branch of electrical work. While the electrical side of the question had been thoroughly considered, and dimmers had been produced which would give a most gradual and satisfactory manipulation of the lights, yet it seemed to many, and to the Ironclad Resistance company among the rest, that the mechanical makeup of the modern theatrical bank was not what it should be.

The improvements embodied in the apparatus of the Ironclad Resistance company are stated as follows: First, the plates—of the well-known Ironclad type—with all lever parts, etc., are made to jig and are interchangeable; second, there is provided an extremely rigid framework, complete in itself, on which each plate is independently mounted and positively fixed, but from which any one may be independently removed without interfering with any other portion of the bank; third, the master lever shaft is carried in adjustable self-centering bearings attached to the framework and clear of the plates; fourth, the interlocking connections are such that lack of alignment of the operating parts is powerless to affect their perfect operation; fifth, adjustments are provided in every place where they are only for the employment of a screw-driver, and in addition, in an interlocking bank, the slacking off of the two turnbuckles in the flexible connections. The transmission of the pull of the master lever over circular sectors insures an equal strain in all portions of the arc and renders cramping impossible.

It is sometimes desirable to so arrange a bank of interlocking dimmers that movement of the master lever will cause some of the contact levers to travel in the opposite direction, while others follow the master lever as ordinarily, thus brightening the lights on one circuit and simultaneously dimming them on others with a single movement of the master lever. This is accomplished in the present instance by simply crossing the interlocking connections in the manner of a crossed belt, as shown in Figs. 4 and 5.

Provision is also made to allow for the setting of any individual dimmer in any desired position, from full light to no light, and then automatically carrying it from that point by the simple movement of the master lever. This is done by providing a circular arc, concentric with the lever stud, upon which the interlocking bolt travels before engaging.

That the extreme simplicity and flexibility of this apparatus, together with the other features embodied therein, are meeting with the approval of that part of the trade which calls for the highest grade of material, workmanship and adaptability seems to be shown by the success which has met the introduction of the dimmers to the market, as the Ironclad Resistance company has within the last few months installed banks of this type in three of the best theaters in New York city—the Empire, Broadway and Criterion—and in addition thereto has shipped six banks to other portions of the United States and five banks to England and the continent of Europe, besides shipping large numbers of individual and small groups of unbanked dimmers to different parts of this country and Europe.

In the illustrations, Fig. 1 represents a bank of interlocking dimmers in the Empire Theater, New York; Fig. 2, bank of non-interlocking dimmers; Fig. 3, the frame, ready for mounting plates; Fig. 4, interlocking connection open; Fig. 5, interlocking connection reversed.

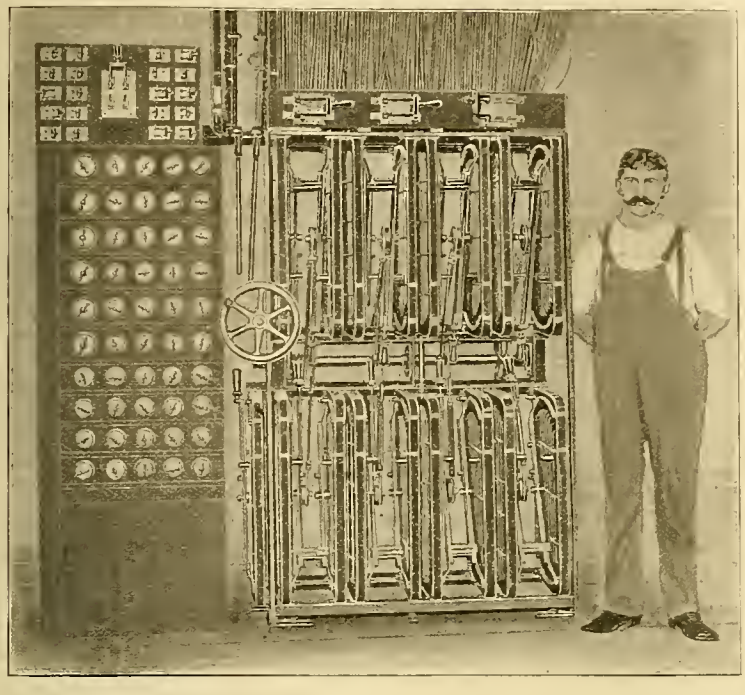


Fig. 1.

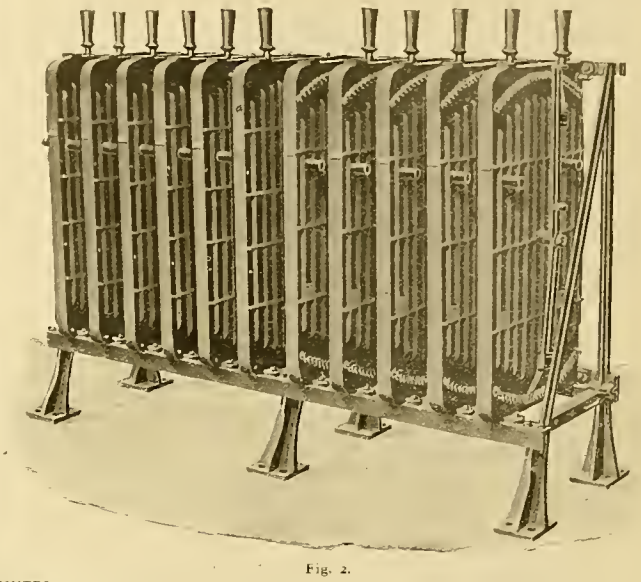


Fig. 2.

NEW THEATER DIMMERS.

Fig. 4.

Fig. 5.

Electric Necktie Pin.

William Roche of New York is introducing a pretty novelty in the form of a combination electric necktie pin. The lamp is easily separated from the pin, and can be placed quickly in a flower or bouquet, producing a delicate and artistic effect. The lamp used in this outfit is the regularly made incandescent kind. It can be used for light in dark closets or in any place where a light is required without danger of fire, thus combining usefulness with amusement.

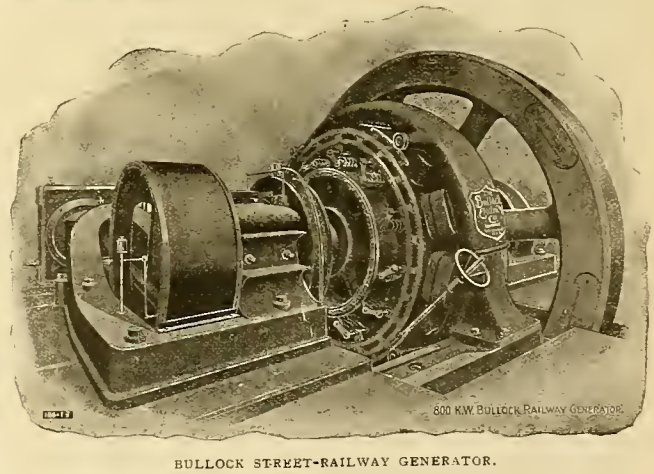
ELECTRIC NECKTIE PIN.

Bullock Street-railway Generator.

The Bullock Electric Manufacturing company of Cincinnati has entered the railway field. The direct-connected generator shown by the picture was sold to the Oakland Rapid Transit company of Oakland, Cal. It operates at a speed of 80 revolutions per minute and develops 550 volts at no load. It is over-compounded for a rise of 50 volts at full load, making the full-load voltage 600.

Among the features of the Bullock street-railway generator is a scheme for oscillating the brush-holder mechanism in a direction parallel with the shaft. The movement is very slow and results in constantly changing the line of travel over the commutator face and thus removes all tendency to cut or groove the latter. The action is the same as secured by the end play of an armature in a belted generator or that produced by the electromagnetic device used at the end of shaft on rotary transformers.

The pole-pieces and coils may be removed without disturbing the yoke or armature, and with two



BULLOCK STREET-RAILWAY GENERATOR.

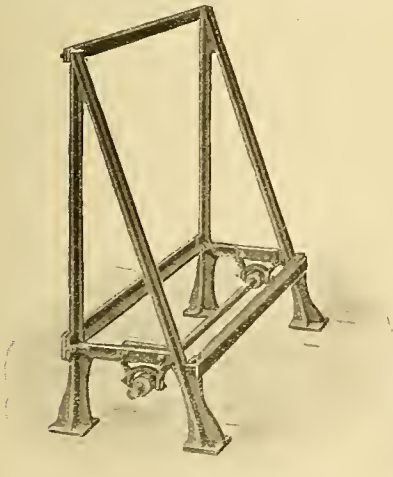


FIG. 3. NEW THEATER DIMMERS.

in any way necessary, thus insuring the operation of all the parts under all circumstances.

It is obvious that a bank of dimmers so constructed may be shipped "knocked down" and assembled at its destination without the necessity of the employment of skilled labor; and in the case of large banks or great shipping distances or installation in inaccessible positions this is a much appreciated feature.

The cuts make evident, with but little necessity for explanation, the method of construction adopted. The frame (Fig. 3), of angle and tee iron, represents what is undoubtedly the most rigid construction ever employed for this work, while the removal of a plate in a non-interlocking bank calls

of them removed, it is possible to remove one or more armature coils should repairs be necessary.

The armature coils are made of continuous bars of copper without joints between the commutator connections, which materially adds to the life of the machine. These coils are all thoroughly insulated, pressed and baked before being placed on the core, no additional core insulation being necessary.

Controversy and Conflict in Camden.

Divergent views as to the setting of an electric-light pole in front of the new government building in Camden, N. J., brought on a collision between employes of the Camden Lighting and Heating company and the federal authorities last week. The disputed site for the pole is on the corner at Third and Arch streets. The company sent a force of men to set the pole, but the government employes objected, and as a result 14 of the workmen were arrested, but soon after released on nominal bail. The company has had a pole in the angle formed by the Third street curbs for an extended period. To get rid of it the architect of the new government building changed the form of the curb from an angle to a curve, thus leaving the pole out in the street. It was the attempt to reset the pole to a position within the curb lines that caused the battle. Counsel for the lighting company declare that it has a vested right in the highway at the point in question and that neither the city nor the federal government has any right to dispossess it. Judge E. A. Armstrong, the president, and J. J. Burleigh, manager, of the Camden Lighting and Heating company, are prominent members of the National Electric Light association and very well known to electrical men generally.

Calumet Electric Railway.

It is said that there is a possibility that the plant of the Calumet Electric Street Railway company in the southern suburbs of Chicago may be sold to the capitalists interested in the new Chicago Union Traction company. The system is now operated by the receiver of the defunct National Bank of Illinois as a part of the assets of that institution. Improvements proposed by the receiver, involving an expenditure of nearly $125,000, have been approved by the United States Court. Considerable sums have already been expended in improvements and betterments and in the purchase of new rolling stock. As a result of this the traffic has increased materially of late, and it is said the company has now a traffic which more than takes care of all of its fixed charges and operating expenses. The following expenditures for improvements were authorized by the court last week: To reconstruct the Pullman line, $77,337; to lay second track in Sixty-seventh street, $3,898; to improve terminus at Halsted, $500; to relay tracks on Stony Island avenue, $0,000; to pave South Chicago avenue, $5,000; new crossing at St. Lawrence avenue, $500; to pave Avenue L and lay new track, $25,000; fenders, $1,500; to purchase joint-casting machine, $3,500; total, $123,195.

RECENT X-RAY NOTES.

A dispatch from Dayton, Ohio, states that Dr. T. A. McCann of that city located a horseshoe nail in the windpipe of a boy by the X-ray process, and then extracted the nail by means of a powerful magnet. The boy is Clarence Grady of Indianapolis.

The removal of a portion of the backbone is a delicate and rare operation in surgery. It was recently performed in a New York hospital by Dr. Robert Abbe, the patient being Mr. Duryea. By the use of the X-ray apparatus the doctors found that the fifth vertebra was fractured, and they removed the posterior parts of the fifth and sixth vertebræ, which were pressing on the spinal cord, thus removing the pressure that had produced some of the symptoms.

Experiments in Chicago of recent date show that skiagraphs, like all other pictures, may be made to deceive, if the operator is so minded. At the instance of street-railway attorneys, Dr. H. P. Pratt has made X-ray pictures which apparently indicated foreign substances in the body or crushed and distorted bones, when, in fact, there were no abnormal conditions. The deception was attained by cramping the joints shown or by placing a foreign substance outside the body, to be shown as though inside. Dr. Pratt also contends that it is possible for an operator to change the apparent location of the object when inside of the body by manipulation of the focus. The lawyers say that the experiments show that the skiagraph can be made to lie if the process is manipulated for that purpose—which, of course, everybody knew before—and that the competence and integrity of X-ray operators must be proved for the admission of skiagraphs in evidence.

A new electric-railway company has applied to the City Council of Joplin, Mo., for a charter. The new road is said to have considerable eastern capital behind it, and if the desired franchises are granted it will be built from Joplin to Belleville, Central City, Duenweg, Grand Falls and other mining camps not now reached by the Southwest Missouri electric railway.

ELECTRICAL TRADE ABROAD.

Electrical Undertakings in Russia.

The electrical industry in Russia in the form of stock companies is chiefly a creation of foreign, especially German, capital, and of a quite recent date. Only 10 years ago Russia had but one electric stock company, the Electric Lighting company of St. Petersburg and Moscow, formed in 1888. All the others have come into existence during the last five years. At the end of 1898 the number of companies amounted to 20, five of which were purely foreign companies, while the rest of them, in name at least, figured as Russian concerns. In the latter class is the Electric Lighting company, which was formed with a large share of German capital by the firm of Siemens & Halske of Berlin. In 1896 the declared stock of the company, valued at 4.100,-000 rubles, was exclusively subscribed for in Germany. (A ruble is valed at about 52 cents in American money.)

In 1894 the firm of Sawitzki & Strauss of Kieff was converted into a stock company, with a capital of 450.000 rubles. The company supplies the cities of Kieff and Poltava with electric light and furnishes power for industrial purposes. During the first three years of the company's existence dividends of eight per cent., one per cent. and six per cent. were paid, while in the last two years no dividend was paid. In the same year, 1894, the Russian Company for the Utilization of Electric Power (capital, 500.000 rubles) was formed. This company did not begin active operations until some years later, and the result of these operations was not a financial success.

Then followed in 1895 the Electric company M. M. Podobedow. At first this company seemed to develop favorably: for the first year a dividend of four per cent. was realized, and the stock was for a time the object of keen speculation on the St. Petersburg Bourse. Then a perceptible reaction took place, and at present the company is in an embarrassed position. In 1896 the Electricity company was formed at Warsaw (capital, 1.200.000 rubles) by bankers and manufacturers of Warsaw. It has so far been successful, although no dividends have been paid as yet. Then came the Russian Electric Railway and Lighting company, formerly R. v. Hartmann & Co. (capital, 1.000.000 rubles). This company was formed for the purpose of operating the electric railway at Nischni-Novgorod, at the Great Pan-Russian Fair of 1896. Its first year of existence closed with a considerable loss.

Mention should also be made of the following-named companies, which have never been in operation or only during the last year, so that no account of their business can as yet be given: Russian Electro-mechanic company (capital, 4.500.-000 rubles), the principal object of which is to build and operate locomotives and electric railways on Jean Jacques Heilmann's system, the stock being chiefly in the hands of Frenchmen; Russian Accumulator Works, Tudor, with a capital of 600,000 rubles); Northern Electric company (capital, 1,200.0.0 rubles), for the electric lighting of the suburb, Wassili-Ostrow, near St. Petersburg; the Wuoxen company (capital, 5.250,000 rubles), for the utilization of the waterfalls of the River Wuoxen for electric power, and in which a good deal of foreign capital is represented, a large shareholder being the firm of Brown, Boveri & Co. of Baden, Germany; the St. Petersburg company for the Utilization of Water Power for Electric Purposes (capital, 6,000,000 rubles), for utilizing the power of the waterfalls near Narva and of the Imatra. Then come the Siemens & Halske Russian Electro-technical Works (capital, 4,000,000 rubles) and the Russian Electric Company Union (capital, 6,000,000 rubles), both of which are chiefly dependent on German capital.

Of the foreign companies operating in Russia three are Belgian, viz., Compagnie Centrale d'Electricité á Moscou Eclairage Electrique de St. Petersbourg and Compagnie de Traction et d'Electricité; two are German companies, the Helios Electric company of Cologne and the General Electric company of St. Petersburg. Of these companies, the first-named supplies the cities of Rostov-on-Don and Jekaterinburg in Southern Russia with electric light; it has been very successful, clearing 82,522 francs in 1896-97, from a capital of 1.500.000 francs, and 109.588 francs in 1897-98. The Compagnie de Traction et d'Electricité has a half interest in the street railways of Tula, Kronstadt, Reval, Vilna, Minsk, Woronesch and Samara. St. Petersburg is the principal field of operation of the other three companies. They supply electric power chiefly for lighting and industrial purposes.

It should also be mentioned that several of the numerous Belgian street-railway companies, strictly speaking, belong to this classification, as some of the newer ones not only build electric street railways, but also furnish electric light and electric power.

Thus, it is evident that everything of any importance in the electric industry owes its existence to foreign capital and foreign enterprise. The domestic companies have not succeeded in any respect and are of no importance. The combination formed lately in Berlin for electric enterprises in Russia will probably still more strengthen and increase this state of affairs. Of the above-mentioned firms the following-named are members of this newly formed syndicate: Electric Lighting company, Siemens & Halske and the Union. Taking the influence and financial power of the International Commercial Bank of St. Petersburg into consideration, there is little doubt that the new combination will occupy a prominent position among the electrical industries of Russia. The syndicate has a capital of 20,000,000 rubles. The board of directors consists of seven members. The headquarters are at St. Petersburg, and the banking house of Rothschild Fréres of Paris is also represented. The Société d'Etudes Russes of Paris and the Franco-Russian Electric company of Geneva, Switzerland, are also interested in the syndicate.

The imports of all kinds of electrical machinery into Russia are steadily increasing. The latest available statistics on the total importation are those for the year 1897, when the imports of dynamo-electric machinery alone amounted in value to 1.733.000 rubles, as against 1.214.000 in the previous year. About two-thirds of this trade is in the hands of German manufacturers. G.

Germany.

A most interesting feature of this empire's development, writes Consul Monaghan from Chemnitz (July 25th) is found in the number of electric plants in course of construction and projected. French writers, notably Emile Gautier, Charles Bos and J. LaFargue, are trying just now to arouse French emulation. It seems to me that American manufacturers might obtain contracts to furnish some of the materials needed in the plants. A large company has been organized here to build an electric railroad from this city (Chemnitz) to Burgstaedt, 12 or 15 miles away. As projected, the road is to be run through many large and important villages. If continued to Mitweida, as some think it will be, should no rival concern open an opposition line, the distance covered will amount to 30 or more miles. There is also a project to build a central electric plant for supplying the road with power and the villages through which the road is to pass with electricity for light. Chemnitz has a population of nearly 200,000 souls; the towns included in the plans referred to contain about 75,000. The company expects to expend $357.000 on the road and a similar amount on the buildings. Besides this, a cable road is being surveyed to Augustusberg, a well-known resort, a few miles outside the city. While the disposition to patronize home industries is very strong here, I cannot help thinking that we must have certain things which, once seen, would win their way to favor.

An interesting question is: How can an American house hope to obtain concessions or contracts? The best way, it seems to me, would be to send one or two experts, familiar with electric plants and their needs, to study the situation. What is true of Chemnitz is true of almost every city in the empire. In the month of June there were 330 railroads projected in the empire. Of these 73 were electric roads; 122 electric plants were projected during the same time. It would be easy for an expert to keep himself posted, by visiting or communicating with the United States consuls-general in Berlin, Frankfort and Dresden. Patriotism has seldom been pushed so far as to force private companies to take inferior or dearer home products.

The market here just now is so large—consequently, so important—that an effort should be made to sell in it, even at the risk of not making a great deal of money at the outset. The methods that have helped at home must help here. A report made by an expert who has gone carefully over the ground would supply specific details in a way not possible to consuls.

South Africa.

A recent issue of the British and South African Export Gazette contained the following items of electrical interest: The electric-lighting installation ordered by the Langlaagte Exploration and Building company, for the Mayfair township, Johannesburg, has been delivered. The electric-lighting and power plant of the Globe and Phœnix gold mine includes a 30-kilowatt generator of the four-pole type. A 15 horse power motor is also to be installed at an early date. A complete electric-lighting equipment is under order for the Surprise gold mine, Rhodesia. An additional generator for supplying power to the slimes plant is to be erected at the New Primrose gold mine. Considerable orders for telephone plant and material for the East London (Cape Colony) telephone service are in the hands of makers. The equipment of the Kimberley electric-lighting scheme, the contract for which is being carried out by Rennert & Lenz, Johannesburg, includes four dynamos, each of 75 kilowatts, 220 volts, and a capacity of 300 amperes. They are being manufactured by the General Electric company (United States). The cables employed will be from the works of Messrs. Johnson & Phillips. A Fowler-Hall alternator of 180 kilowatts has been erected at the East London Electric Lighting and Tramway Works, and a second is on order. These are to be used for incandescent street and private lighting. The two tramway and arc-lamp machines are also of 240 horse power each. An order for two dynamos, each capable of an output of 350 kilowatts

as a continuous load, to cost £3,150, has been placed with the South African General Electric company (Messrs. G. Findlay & Co.) by the Capetown Town Council. The dynamos, we believe, will be of American pattern.

South America.

The entire South American continent offers a promising field for electrical trade to the United States, and that our electrical manufacturers are beginning to appreciate this fact is evident from the export figures for the past year, which show large gains over the preceding year, especially in electric street-railway equipment. Taking into consideration the enterprise of our American electrical manufacturers and the growing importance of their trade abroad, it is scarcely to be doubted that they will within a short time secure a much larger portion of the trade of Central and South America than they now have.

In striving for the South American trade it would be well for our manufacturers to copy from European manufacturers, who not only study the requirements of the trade, but strive to win it by a careful attention to the smallest details. Invoices are made out in the Spanish language, and all information in connection with articles offered for sale is in the same tongue. Especial attention is paid by European shippers to the marks, numbers and methods suggested by the importers; and particular stress is laid upon this point, for it is complained in South America that American manufacturers either cannot or will not pay attention to shipping directions. As a matter of fact, merchants in these countries give very explicit directions even to the minutest details, which, though they may seem superfluous to Americans, are given by a man on the spot who is thoroughly in touch with his subject.

Melancholy Manchester.

Commenting on the announcement of the establishment in England of an electrical manufacturing establishment by the British Westinghouse Electric and Manufacturing company, a correspondent of the Manchester Evening Chronicle says: "The announcement has been made, and with the usual flourish of the Yankee trumpet, that electric works, such as were never yet seen, are to be erected in Trafford Prak, Manchester. This statement may be true, but it is hardly fair that British electric manufacturing concerns should have been so absurdly depreciated in this connection. As an instance, it is stated that the Westinghouse company is now making four large electric generators for the Manchester corporation, which it is inferred no English maker could touch. As a matter of fact, Messrs. P. R. Jackson & Co., engineers, Salford, offered to make these very machines, and to comply with all the conditions set forth in the specification of the corporation. The order was given to the Yankee firm, notwithstanding the fact that the price of the Salford firm was only £800 higher in a £70,000 job. However, it may interest your readers to know that the Westinghouse company has come rather late in the day, as events will, I think you will find, soon prove. I suppose the next boom will be new Yankee locomotive works, simply because all our 'loco' shops are crowded out with work at much higher prices than obtain elsewhere."

Electric Tramways in Nice.

The following, dated Nice, August 11, 1899, has been received from Mr. Piatti, the United States vice-consul: "In the course of an interview which I had yesterday with the mayor of Nice, I learned that the new electric tramways which were to be operated about October 15th will, until the 15th of December, be run by horse power. The reason given is that the existing telephonic wires are not of sufficient strength to resist being affected by the power used for the tramways, so that they must be replaced by strong cables placed underground; but not a single concern, it is said, can be found in France to deliver the necessary cables before November 1st. This, in itself, may not be a fact of paramount importance; but reverting to the continuous attempt made by this consulate to induce our manufacturers to cultivate the very considerable opportunities offered by the port of Nice for a direct trade with the United States, it may not be out of place to say that in this instance, an American firm might have competed with success in furnishing the necesary electric cables."

Brotherhood of Electrical Workers.

In testifying before the Industrial Commission at Washington, R. W. Sherman of Rochester, N. Y., secretary of the National Brotherhood of Electrical Workers, stated that most of the members of the organization were linemen. He said that the dues of his organization were 60 cents a month. There was a $100 death benefit. There had been 13 strikes in the organization in 18 months; of these the organization had won 11, had compromised one and one was still on. The organization did not include more than two per cent. of the electrical workers. As a rule the workers had steady employment. There was much extra work, for which extra pay was obtained. The average pay was about $3 a day. His organization believed in compulsory arbitration.

Went to Sleep on the Belt and Was Killed.

Albert Clary, chief engineer at the Southwest Missouri Electric Railway company's power house at Webb City, Mo., was killed by an unusual and distressing accident last week. Mr. Clary had been assisting the night engineer, Tom Sterling, in making repairs to the machinery in the boiler room, and when this was finished Mr. Clary walked into the engine room, where he went to sleep on one of the broad belts connecting with the generators. Sterling, who supposed that Mr. Clary had gone home, a short while afterward started up the machinery to see if it would work all right, and when he discovered the frightful work of the revolving belt he was horrified. Mr. Clary had been crushed to death. The deceased had been in charge of the machinery for several years and was well liked by the employes. Night Engineer Sterling is also a trusted employe and he is greatly depressed in spirit because of the sad accident. Mr. Clary was a young man, and a wife and two children survive him.

Suburban Railways about Detroit.

In Detroit, Mich., there are 185 miles of purely city lines and 121 miles of suburban lines, directly connected with the city lines, which reach to cities and towns lying in various directions from the city, some being 50 miles distant. Other suburban lines are now building, and will be in operation before the close of the year, which will add over 100 miles to the total suburban mileage. The new Detroit and Northwestern railway, building through Greenfield, Sand Hill, Clarenceville, Farmington, Northville, Orchard Lake and Pontiac, is one of the new roads. The cars to be run on this line will be of the latest improved pattern and fitted out with fire extinguishers, call bells, ice water, brussels carpet, cuspidores and lavatory, and will be given romantic names. This road is scheduled to be in operation by December 1st.

Automatic Telegraph Sender.

C. M. Baker of Chicago, superintendent of construction of the western division of the Postal Telegraph-cable company, is en route to Amsterdam, Budapest and other European cities, and it is said that one purpose of his journey is to study the workings of an automatic telegraph sender. It is asserted that this machine will transmit 50,000 words in 25 minutes, which is a very great saving in time over any of the present methods of sending messages by telegraph. It is believed that Mr. Baker is sent by Chicago capitalists who are interested in the new invention (probably that of Pollak of Vienna), and if the tests and trial which are to be made result satisfactorily, the machine will be introduced in this country.

Chicago Automobile Exhibition.

The automobile show that is conducted under the auspices of the Arena Athletic club in connection with the club's cycle meet at Tattersall's in Chicago is scheduled to open on Thursday evening, September 28th. George R. Frankland, who is managing the exhibition, expects between 20 and 25 horseless vehicles to be shown, including the automobile gun carriage recently built for Major Davidson of the Highland Military Academy. Besides the above vehicles, which, with exception of Major Davidson's gun, are to be exhibited by the manufacturers, a number of private owners of automobiles have promised to have their carriages on view one evening.

TRIFLING TECHNICALITIES.

Twinkle, twinkle, little star—
Once we wondered what you are;
Since we have electric light,
You don't look so killing bright.
—Detroit Free Press.

Inventor—What is your candid opinion of my device?

Friend—It is practically worthless.

Inventor—Yes; I suspected as much; but even a worthless opinion is sometimes better than none.—Chicago Daily News.

"I am in mortal terror!" exclaimed the agitated maiden, who was preparing to elope. "If the horses should whinny we are lost!"

"Horses!" said the waiting lover, tenderly reassuring her. "Darling, it is an automobile!"—Chicago Tribune.

"Isn't it awe-inspiring," said the youth with tendencies toward the sublime, "to think of this earth rushing forever forward on its track, superior to all human direction and beyond all restraint?"

"Yes," answered the fair girl, softly, after a long pause. "It makes me think of my new automobile."—Washington Star.

This fish story is promulgated by the New York Tribune: On Moosehead Lake, Maine, an angler was fishing with a steel rod during a thunderstorm and struck a trout at the same instant that a thunderbolt dallied with his rod. The cork handle prevented the angler feeling anything more than a slight shock, but when he hauled it in he found the trout stone dead. He figured it out that the lightning bolt followed the rod and the enameled line down to where the trout had just taken hold of the hook, and there killed him.

CORRESPONDENCE.

New York Notes.

New York, September 25.—It is really a piece of important information, which should be in possession of every electrical man outside the city of New York, that it will be next to impossible to get a room in any of the New York hotels the week of the Dewey celebration. Anyone coming to New York hoping to be treated as an old customer by "Charley" behind the hotel desk, will be surprised by a stony stare and the remark "I'll do the best I can for you," which only goes to mean that you may get a cot, but this is even doubtful.

At the meeting last week of the Electric Vehicle company the following-named were elected directors: Isaac L. Rice, Martin Maloney, Robert McA. Lloyd, John Jacob Astor, George H. Day, Arthur Phillips, Thomas J. Regan, Daniel H. Shea and Joseph M. Hill.

It was reported at the close of business last week that Amalgamated Copper directors had declared a dividend of 1½ per cent. and ½ per cent. extra on their stock. Rumors to this effect have been in circulation for several days and have influenced the course of the stock in the outside market, although denied by insiders. Anaconda Copper directors met during the day and declared an extra dividend of 75 cents per share in addition to the regular semi-annual $1.25 per share.

A brilliant feature of the Dewey celebration is to be the electrical illumination of the fleet of war vessels on Friday and Saturday nights at their anchorage in the North River off Riverside Park. Every vessel having an electrical plant will present its own life-size portrait etched in fire. The signal to illuminate will be given from the Olympia at half-past seven o'clock and will be obeyed simultaneously on all the vessels of the fleet. The turning off of the lights will also be on signal from the Olympia at half-past nine o'clock.

At Greenport, N. Y., on Friday, the submarine torpedo boat Holland, operated by gasoline engines and storage batteries, made a remarkably good showing on her practice trial. Aside from the regular run of a mile under water at a uniform depth of seven feet, she discharged a regulation Whitehead torpedo, such as those used in the navy. Her trial lasted 1½ hours and was witnessed by W. R. Eckhert, consulting engineer of the Union Iron Works of San Francisco, builders of the battleship Oregon and Dewey's flagship, the Olympia.

At the annual meeting of the stockholders of the Edison Electric Illuminating company of Brooklyn, held Thursday, the following-named directors were elected for the ensuing year: Nicholas F. Brady, Daniel J. Creem, A. W. Dater, Horace C. Du Val, J. D. Fairchild, Bernard Gallagher, John G. Jenkins, Thomas E. Murray, Royal C. Peabody, Henry Seibert, W. F. Sheehan, James N. Wallace and A. M. Young. At the meeting of the directors, following the stockholders' meeting, the following-named officers were elected: President, Bernard Gallagher; first vice-president, Henry Seibert; second vice-president, Royal C. Peabody; secretary, W. W. Freeman; treasurer and assistant secretary, A. W. Dater; assistant treasurer, A. N. Neilsen.

Montclair, N. J., has granted a franchise to the North Jersey Street Railway company for a street railway through Elm street and Orange road to the Orange line. The ordinance provides for a 10-cent fare to Newark until 1901, when it is to be eight cents. The rate of fare from Verona, Bloomfield or Montclair to Orange, when the road is extended to that city, is to be five cents.

Herman Neilsen, a clerk in a grocery store at 717 Broadway, Williamsburg, was almost instantly killed Wednesday by a shock from an incandescent lamp which he attempted to light. A high-tension conductor had evidently crossed the incandescent-light wire.

During the last 10 days the aggregate transactions in the shares of Brooklyn Rapid Transit amounted to about 1,200,000. The entire capitalization of the road outstanding is $43,000,000, or 430,000 shares. In the trading of 10 days, therefore, the road has been sold nearly three times over. On Wednesday more than two-thirds of the entire outstanding shares changed hands and the stock fluctuated greatly. Many rumors are afloat to the effect that Mr. Whitney has secured control of the road.

M. L. G.

Detroit, Mich.

Detroit, September 23.—The Citizens' Street Railway company has embarked in the car-building business. Several new cars for the Ecorces, Wyandotte and Trenton railway are the work of its shops.

The council judiciary committee will take up complaints that have been made as to the blocking of Third and Griswold streets with suburban freight and also the running of electric freight cars through the streets.

The company owning the new Jackson, Charlotte, Albion and Marshall railway has acceded to the stringent demands of the city of Marshall and will pave one foot outside and between tracks, pay $5,000 cash for the privilege of the streets, with $200 a year annual rental, and sell tickets on a basis of eight for a quarter. Marshall therefore gains what Governor Pingree has battled for for 10 years past.

The Detroit, Ypsilanti and Ann Arbor Railway

company has filed a petition asking an amendment of the recent order of the Circuit Court that it shall run cars between Addison avenue and the Flint and Pere Marquette railroad crossing every 15 minutes. The company claims that the service entails an extra car and that in five weeks the expense of the extra car was $164 and the receipts but 40 cents.

The recent threat of the Grand Rapids and Indiana railroad officials that if it came to a matter of competing with electric roads they would put on electric cars will have no effect upon the proposed electric line from Kalamazoo to Grand Rapids, for which Kalamazoo recently granted a franchise. A. D. Prosser, who is one of the prime movers in the proposed electric line, said: "Kalamazoo will have an electric line to Grand Rapids by next summer. Work on the Battle Creek line is rapidly progressing. Graders are at work in the vicinity of Comstock, less than five miles from Kalamazoo; steel rails are beginning to arrive in Battle Creek and the laying of steel will be commenced at that end and pushed as fast as the rails arrive."

Governor Pingree refuses to run for mayor. He will not consent to the use of his name in connection with the office. The only consideration which might have led him to accept a nomination to the office of mayor would have been the opportunity of standing upon a platform for municipal ownership of street railways and three-cent fares under the plan proposed by himself. The positive refusal, however, of R. T. Wilson, the principal owner of the street railways, to negotiate further, and the absolute withdrawal of his offer of sale, put an end to Governor Pingree's efforts to make three-cent fares a reality under the proposed plan. The New Yorkers who dictate the policy of the street-railway company in this city, having cast off the municipal-railway deal, have decided that the straight five-cent fare is a pretty good thing, and that they will take the "pound of flesh" their franchises give them in other directions. They will take off all transfer privileges, it is claimed, except those on the Detroit railway lines, which are provided for in the franchises.

The Sisters of St. Vincent's Orphan Asylum, with 250 inmates, enjoyed their annual trolley ride over the Rapid railway to Mount Clemens a few days ago. There were four special cars to accommodate the party and the Evening News newsboys' band furnished music. Refreshments were served, and at Rapid Railway Park a reception was given the members of the party. G.

Northwestern Notations.

Minneapolis, September 23.—It is claimed at South Stillwater, Minn., that the reports of trouble between the Twin City Rapid Transit company and the council of the village are all wrong. The council has been ready to grant the requests of the company in most instances, and the differences have all been of a minor description. Owing to the difficulty in getting iron, the extension to South Stillwater will not be made until next July. It is rumored at Taylors Falls, Minn., 30 miles north of Stillwater, that the officials of the Twin City Rapid Transit company are considering an extension to that place next year.

The Citizens' Traction company has completed its interurban line from Oshkosh, Wis., to Neenah, and put it in operation. The line has not been in complete operation, as the railroad crossing in Neenah has not been completed, but service has been very satisfactory otherwise. The Neenah authorities propose to move the tracks of the Fox River Valley company on the disputed street, to make room for the Traction company's tracks. The Fox River company is understood to be desirous of selling the tracks in the disputed location to the Traction company.

The St. Paul Gas Light company proposes to use the power generated at Apple River Falls, Somerset, Wis., to furnish power for its electric street lighting next year in St. Paul. The falls are 30 miles away and the power will be transmitted by wire overland.

Mount Pleasant, Ia., has a rule fixing a minimum rate of 50 cents a month for electricity, no matter if the meter shows but three cents' worth used. J. C. McCoid, a citizen thereof, disputes the justice of the rule and refused to pay his 50 cents for light he didn't use. The light was shut off his premises until he pays up. He now threatens a suit for damages.

C. W. Behnke & Son have been awarded a contract for electric street lighting in Brillion, Wis., and will install a plant.

The Electric Light and Power company of Mauston, Wis., has begun work on a new power house. Orders have been placed for a new engine of 150 horse power, a boiler and two water-wheels of 150 horse power.

The Houghton County Street Railway company has finally secured a charter on sufficiently liberal lines to permit the construction of an electric belt line through the copper country in the upper Michigan peninsula. The main line between Houghton and Calumet will be first constructed. Work will be begun at once.

The council of Rice Lake, Wis., has contracted with the Electric Light and Waterworks company for 14 lights at $90 per light per year for five years.

Townsend, Reed & Co. of Chicago are understood to be interested in an electric railway, to connect Omaha and Council Bluffs with Lake Manawa. The investment at Omaha and Council Bluffs will not exceed $500,000, it is said.

Stock is being subscribed for an electric-light company for Charles City, Ia.

The council of New Richmond, Wis., has bought the electric-light plant from the New Richmond Electric Light company, the price being $10,000.

The council of Olivia, Minn., is considering an electric-light and waterworks system for the village.

The Equitable Electric Light company of Lake Geneva, Wis., finds its water power not equal to the demand for light.

H. G. Flieth, A. W. Trevitt and others have applied for a franchise for an electric street railway at Wausau, Wis.

A project of considerable magnitude has been made public at Beaver Dam, Wis. It is for an electric railway to connect with Portage and Fond du Lac, Wis., taking in Columbus, Beaver Dam, Sun Prairie, Juneau, Waupun and Horicon.

A local improvement society is proposed at Cloquet, Minn., which is to devise means to secure electric lighting.

The specifications for lighting the city of St. Paul next year will divide the city into districts, and it is hoped to get bids from small plants to light the territory in which they are located, and thus secure better figures.

H. M. and C. G. Neff have bought the electric-light plant in West Union, Ia., and will make a number of changes and improvements to it.

The council of Stillwater, Minn., rejected all the bids for electric street lighting, after the lowest bidder withdrew his bid, and will take new bids at once.

Austin, Minn., is taking bids for furnishing an electric-lighting plant. R.

PERSONAL.

Howard Scott Webb has been appointed professor of electrical engineering at the University of Maine.

City Electrician Raymond has resigned his position in New Orleans, and the vacancy will be filled next month by means of a civil-service examination.

Professor Nicholson, who resigned from McGill University, Montreal, to go to the Manchester (England) Technical Schools, is succeeded in the chair of mechanical engineering by his former assistant, R. J. Durley, B. S. of London University.

James F. Gray, who, at the time of the World's Fair, was secretary of the mechanical and electrical engineering staffs of the Exposition company, and who was later connected with the Chicago Edison company, has accepted a position with Sargent & Lundy, the consulting engineers of Chicago.

Friends of Mr. J. Henry Goehst, superintendent of construction for the Chicago Edison company, will sympathize with him in the loss of his father, who died on Thursday, September 21st, from a stroke of paralysis. Mr. Goehst, the elder, was in his 70th year and survived less than 48 hours after receiving the fatal stroke.

Dr. Gordon Ferrie Hull, who, since the death of Dr. Rogers, has held the professorship of physics and astronomy at Colby University, Waterville, Me., has resigned his place there to accept the associate professorship of the department of physics at Dartmouth College. He accepted the chair of physics in Colby in 1897. Dr. Hull has made an especial study of light waves and electricity.

William W. Dodge, treasurer of the Dodge Manufacturing company, Mishawaka, Ind., and one of the principal owners of that company, is dead. He was a brother of the late Wallace H. Dodge, founder of the company. He was born in Mishawaka, January 18, 1861. Mr. Dodge assisted in organizing the Western Gas Engine company at Mishawaka, of which he had been president since the beginning of the undertaking. He married Miss Nettie Ford, in 1890, who, with a son, survives him.

The will of the late Jacob F. Schoellkopf of Buffalo has been filed for probate with the surrogate of Erie County. One of its provisions leaves the Niagara Falls Hydraulic Power and Manufacturing company's stock which he held in the hands of five trustees in trust, with instructions that the power business be continued by the trustees for at least 10 years, when they will be at liberty to dispose of the stock to a purchaser, the proceeds to be equally divided among the children of the deceased.

Mr. C. J. Field, engineer and contractor, who has for the last year and a half been identified with and interested in the American Vitrified Conduit company as general manager, has severed his connections with that company to take the position of vice-president and general manager of the United States Motor Vehicle company of New York city. Mr. Field also proposes to continue his separate business interests as a consulting engineer and contractor on central-station, railway and underground-conduit work.

ELECTRIC LIGHTING.

The capital stock of the Kensington Electric Lighting company of Philadelphia, has been increased to $1,500,000.

The Carbondale (Ill.) Lighting company has been incorporated, with a capital stock of $15,000, to operate an electric-light plant. James R. Hastings, D. I. Sicklesteel and E. Hermes are named as the incorporators.

A special election recently held in Mayville, N. D., resulted in favor of an issue of $21,000 worth of waterworks and electric-light bonds.

An election is to be held at Tallahassee, Fla., on October 10th, to vote on the question of issuing $15,000 worth of bonds for an electric-light plant.

David L. May, W. C. Montgomery and R. G. Phillips of Elizabethtown, Ky., have incorporated the Elizabethtown Electric Light company, with a capital stock of $5,000.

O. A. Cooper of Humboldt, Neb., is building an electric-light plant. The poles are set and the power house is finished, with the dynamos in place. He expects to have the plant in operation in a short time.

The City Council of Roswell, Ga., has granted franchises to the Roswell Electric Street Railway, Light and Power company for the construction of an electric line and operation of an electric-light plant.

ELECTRIC RAILWAYS.

The Erie Canal Traction company of New York state has been incorporated under the laws of Delaware, with a capital stock of $5,000,000.

The Leavenworth and Lansing electric railway has been sold to the Kansas City and Leavenworth Traction company, the price of the purchase being $5,000.

The overhead trolley equipment put in use on State street, Chicago, while the cable plant of the Chicago City Railway company was being repaired has been removed.

The Temple Street Cable Railway company of Los Angeles, Cal., has received permission to change the motive power of the road to electricity and the work will be begun at once.

The San Diego (Cal.) Electric Railway company has decided to adopt the storage-battery system on its lines, it is said, and the work of changing the equipment of its cars will be commenced soon.

Rights-of-way within Kent County, Del., have been granted to the Delaware General Electric Railway company for an electric railway from Milford through Dover to Woodland Beach, a distance of 35 miles.

J. E. Lowes and J. E. Feight of Dayton, O., have been granted a franchise for the construction of an electric railway from Dayton, extending through Brookville, Gordon, Ithaca, Arcanum, Jays and Eaton to Greenville.

A car on the Southwest Missouri electric railway, running between Joplin and Carthage, jumped the track on the night of September 21st and was badly smashed. There were 30 passengers on board at the time, and all were more or less injured, 14 being seriously hurt.

AUTOMOBILES.

Experiments made in Paris show, it is said, that an electric wagon costs 47 per cent. less to run than a horse wagon and 32 per cent. less than a petroleum motor.

The American Automobile company has been organized in New York to control the manufacture and operation of automobiles and motors in which kerosene or gasoline is used.

The Lanchester Motor company, recently organized under the laws of New Jersey, proposes to erect a factory in Pittsburg, to cost about $400,000, and which will employ about 600 hands.

An automobile cab company organized in Portland, Me., recently, intends not only to do a local business, but also to take passengers up through the White Mountains. The vehicles for the latter traffic will probably be tally-ho coaches capable of holding 10 persons.

C. R. Iungerich and Dr. M. L. Williams have petitioned the City Council of Champaign, Ill., for a 20-year franchise to operate a system of automobiles. The carriages will be run at 10-minute intervals over a regular route, and as soon as the franchise is granted it is stated that a company, capitalized at $200,000, will be organized to further the project.

It is reported that the New York Central Railway intends to establish an electric-cab service in New York and other large cities along the line; that the Pennsylvania Railroad has been experimenting with a sample vehicle, and that it is possible that these carriages may be substituted for the horse-driven cabs at the stations of the company's system.

The National Export Exposition is planning to conduct a general exhibition of automobiles, and is giving every facility for a representative display of these modern vehicles. On the west side of the main building a smooth driveway has been constructed expressly for automobiles, on which trials of speed and comparative tests by horseless carriages will be made daily. Several manufacturers

of vehicles in Philadelphia, New York, Boston and elsewhere will make exhibits of automobiles, showing the application of gasoline, electricity and steam as the motive power.

Some very severe tests have recently been made in Liverpool with heavy horseless vans. Five of these auto-trucks were given different trials on the steepest and most difficult hill in Liverpool, Everton Brow, under the auspices of the Liverpool Self-propelled Traffic association. This hill is paved at different points with macadam, asphaltum, stone and wood, and to make the ascent more difficult the hill was watered in its steepest portions and on the sharpest curves. The trials resulted very successfully. One of the trucks weighed in itself over three tons, upon which was loaded four tons, and a heavy trailer attached with 2½ tons more.

The United States Motor Vehicle company, which was incorporated the first of the month, under the laws of New Jersey, with $1,500,000 capital stock, has opened offices in the Townsend building, Twenty-fifth and Broadway, New York city. This company, it is understood, has secured some strong patents, and has already developed types of gasoline, electrical and other vehicles, and will be on the market shortly with both pleasure and commercial vehicles, comprising different types of carriages, delivery wagons, trucks, omnibuses, coaches, etc. Its different types of gasoline engines are said to be the best ever offered for the different classes of work, and the company proposes to sell them to the trade separately, when desired, and to make marine and stationary types of engines to sell. Mr. C. J. Field, who has been prominently identified with electric-railway and central-station work and the Edison interests for the last 12 years, is largely interested in this company and is the vice-president and general manager.

PUBLICATIONS.

"Gentlemen, the Admiral!" is the toast to Admiral Dewey proposed by the John A. Roebling's Sons company of New York on a neatly illustrated souvenir card.

"Monogram" blowers and exhausters, which are designed to operate against considerable resistance, are illustrated and described in a catalogue recently issued by the B. F. Sturtevant company, Boston.

A new catalogue has just been issued by the Electric Appliance company, Chicago, covering the entire line of Edison, Thomson-Houston and Westinghouse sockets, receptacles, etc. The catalogue illustrates the latest improvements in the socket line. A net price-list accompanies the catalogue.

The Duncan integrating wattmeter for single-phase alternating currents, recently described in the Western Electrician, is the subject-matter of a bulletin recently issued by the Siemens & Halske Electric company of America. Inside and outside views of the meter are given, with diagrams that clearly explain how to read the meter dial and how to make connections with the meter on different wire systems.

How Dixon's flake graphite helps in making records on railroads is clearly explained in an interesting pamphlet issued by the Joseph Dixon Crucible company of Jersey City, N. J. Results of scientific tests are given, which show the value of graphite as a lubricant as compared with the various oils and greases in common use. The Dixon company also manufactures a graphited wood grease which is said to be specially adapted for use on gears of electric-railway cars.

One of the many journals that have appeared in the last few months, devoted exclusively or in part to the horseless-vehicle industry, is The Automobile, which is published monthly by the E. L. Powers company of New York. The September issue of this journal gives a number of short and concise articles appertaining to motor vehicles and promises well for the future. Mr. Powers is well known in Chicago, and many friends wish him success in the new venture.

The Bullock Electric Manufacturing company, Cincinnati, is issuing a bulletin descriptive of the Bullock electric-power system for operating newspaper presses. This system is known as the "teaser" method of control, and as applied to the method of operation of large printing presses is said to possess features of prime importance which are exclusively its own. Illustrations are given of the controller, switchboard, motor and some of the large presses which are driven by the Bullock system.

A well illustrated catalogue, devoted to cranes and air hoists, is being distributed to the trade by the Whiting Foundry Equipment company of Harvey, Ill. It treats fully on electric and compressed-air cranes, which are a specialty of this company, and also contains a full description of other types of traveling cranes, jib cranes, railroad transfer cranes, pillar cranes and special gantry and derrick cranes. Ten pages are devoted to air hoists. A number of illustrations of cranes and air hoists in their actual working conditions are shown. The Whiting company reports that it has better facilities than ever before for manufacturing the most improved electric and compressed-air power cranes, and has a large number of orders from representative concerns for its improved type of electric traveling crane. The catalogue is sent to all interested persons on request.

H. V. and H. W. Poor have just issued the thirty-second annual number of their Manual of Railroads, in which is given in full detail the financial condition and results of all railroads in the country, the several statements having been carefully revised and brought up to the latest date. One of the departments of the book is devoted to street-surface railways. It contains statements of street railways, arranged alphabetically by states, and gives full details of track mileage and rails, equipment, operation and income, capital stock, bonded and other debts, cost of road and equipment, investments, leasehold and other properties, directors, officers, etc.

"Power Motors" is the title of a carefully prepared catalogue that has been recently issued by the Western Electric company. Realizing that no one type of motor or dynamo is equally well adapted to the various kinds of service now met with in practice, the Western Electric company has designed a number of types of machines which are thoroughly up to date and cover all ordinary requirements. The encased type of machine is practically dust-proof and is especially adapted for use in out-of-the-way places where it can receive but little attention. Other types of machines described are semi-enased, open bipolar or multipolar, slow-speed multipolar, dynamotors, twin motor-generators, back-geared motors and direct-connected engines and dynamos. All of the machines are very clearly illustrated and described, and reference diagrams and tables are given which show the different dimensions, capacities and other data concerning them. Interesting information on field windings, methods of controlling motor speeds, sliding carriages, accessories, etc., forms a feature of the book. One part of the catalogue is devoted to applications of motors, and fine full-page illustrations clearly represent some of the various uses to which different types of the Western Electric company's motors have been applied. Information necessary in ordering the machines is given on the last few pages of the book.

INDUSTRIAL COMBINATIONS.

The first steps in the consolidation of 90 per cent. of the bridge-building concerns of the United States are completed, and it seems now almost certain that a gigantic combination of capital known as the American Bridge company will soon be consummated. Representatives of the 30 companies that have formed the combination met in New York recently and appointed a committee to arrange for the final organization. The capital of the new company will be in the neighborhood of $65,000,000, of which $30,000,000 will be preferred stock and $35,000,000 common stock. Among the large concerns that will form the company are the A. P. Roberts company, Pencoyd, Pa.; Edgemore Iron company, of Edgemore, Pa.; Wrought Iron Bridge company, Canton, Ohio; Cornell Bridge company, New York; Carnegie Bridge company, Pittsburg; Youngstown Bridge company, Youngstown, Ohio; Boston Bridge company, Boston; Post & McCord Iron company, Brooklyn; American Bridge company, Chicago; Elmira Bridge company, Elmira, N. Y., and the New Berlin Bridge company, Connecticut.

ELECTRICAL SECURITIES.

The General Electric company has declared a quarterly dividend of 1½ per cent. on the common stock, payable October 14th to stock of record October 3d.

The Westinghouse Electric and Manufacturing company has declared the regular quarterly dividend of 1¾ per cent. on the first preferred stock, payable October 3d to stock of record September 23d.

MISCELLANEOUS.

On the United States army transport Thomas, now refitting by the government, all washing, ironing, lifting, refrigerating, distilling, lighting and other machinery, except that used for propelling the ship, will be operated by electricity.

The owners of the Cripple Hill gold mines, six miles from Hot Springs, Ark., have discovered platinum in their mines. The find was accidentally made while assaying for gold. The assay is said to show five to six pounds of platinum to the ton.

According to The Nation, a Danish northern-light expedition has just left Copenhagen for Iceland. The expedition has been several months under preparation, and its members have been carefully practiced in the use of the instruments. Two stations will be built and will be connected by telephone and by an optical telegraph. The director of the Danish Meteorological Office, Dr. Adam Paulsen, is at the head of the expedition, and he will test his own published theories on the aurora, as well as all of the other late ones of the various scientists. The expedition will return in May, 1900.

The electrical section of the Franklin Institute of Philadelphia announces the following lectures for the evening of October 3d: Dr. Edwin J. Houston, Philadelphia, Pa., "A Summary of Electrical Progress During the Past 75 Years;" Mr. Ralph W. Pope, New York, "The Influence of Such Societies as the Franklin Institute and the American Institute of Electrical Engineers in Promoting the Progress of the Electrical Arts;" Professor F. B. Crocker, New York, "The Commercial Aspects of American Electrical Industries."

TRADE NEWS.

The Metropolitan Street Railway company of Kansas City has placed an order for Hipwood-Barrett car fenders. The Chicago office, through Mr. George E. Weiler, closed the deal.

The Mechanical Equipment company of Chicago has been incorporated with a capital stock of $10,000 to manufacture machinery and mechanical and electric appliances. The incorporators are G. A. Edward Kohler, Franklin W. Kohler and A. Mallory.

The Wayne Construction company of Fort Wayne, Ind., has been incorporated, with a capital stock of $5,000, to install and operate electric railways, waterworks and electric plants. The incorporators are J. C. Knight, H. C. Knight and A. M. Rockwell of Fort Wayne.

W. N. Matthews, the energetic dispenser of electrical specialties and bargains in second-hand machinery, has recently moved into his new offices, suite 600, Carleton building, St. Louis. Mr Matthews has increased his facilities for handling business and will be glad to have his friends make his offices their headquarters while in St. Louis.

The Watertown (N. Y.) Steam Engine company has opened an office in Chicago for western business at 900 Fisher building. Mr. Frank H. Pond is the manager and will have charge of sales in the territory west of Buffalo. Mr. Pond, who has had 25 years' experience in the engine business, is well known throughout the West. He can hardly fail to extend the Watertown company's business in the western country to a great extent.

The Southern Trade Record recently conducted a disinterested investigation for the purpose of finding an adjustable incandescent lamp shade that would afford complete protection to the eyes. Such a shade it claims to have found in the Espersen adjustable shade lamp, manufactured by the Pacific Electric company of La Crosse, Wis. These shades are made in a variety of styles and are reported as giving the best of satisfaction.

The Jantz & Leist Electric company of Cincinnati manufactures multipolar motors and dynamos, and is said to be very well equipped for conducting the business in a thorough and systematic manner. It has a well arranged manufacturing establishment at 808 and 810 Elm street, supplied with the most approved machinery and appliances, and employing a good force of experienced and well trained hands, thus enabling the company to turn out work in the best and most satisfactory manner. The firm designs and makes motors to suit any kind of machinery, and is always prepared to equip light and power plants.

A conservative estimate of Nebraska's corn crop is 300,000,000 bushels. To appreciate better the enormous size of this crop, a little computation shows that if loaded into cars of 30,000 pounds' capacity, it would take 600,000 cars to haul the crop, or a train over 4,000 miles long. It is said that thousands of acres of rich, well-watered lands can still be had in Nebraska and Northern Kansas at comparatively low prices. Opportunity for many to visit this corn country is being offered by the Chicago, Burlington and Quincy Railway company, which has announced cheap-rate harvest excursions for October 3d and 17th.

BUSINESS.

The Berlin Iron Bridge company of East Berlin, Conn., has the contract for furnishing the structural steel work for three buildings for the Ottawa Carbide company of Ottawa, Canada. The floors are carried on steel beams and columns and the flooring is steel plate. The trusses have a clear span, and the roofing is a corrugated iron. The bins for the storage of material are all of plate iron. No woodwork is used anywhere in the construction of the buildings.

Cling-surface is a name becoming pretty well known in the manufacturing world, if inquiries and sales are an indication. The Cling-surface Manufacturing company of 177-182 Virginia street, Buffalo, N. Y., reports that it has just established a branch in Johannesburg, South Africa, to meet the increased demand for Cling-surface in that section. A recent letter from a prominent mechanical engineer says: "Your Cling-surface was a complete revelation to me, and belts that formerly had to be run so tight as to cause a great deal of noise are now running slack and quiet, with not the least evidence of slipping. I heartily recommend it for leather belting, for in addition to its increasing the pulley capacity of a belt, I find the belts are soft and show a fine glossy, yet very clinging surface."

The Western Electrical Supply company of St. Louis reports that on account of the phenomenal increase in its business, it has recently been compelled to double its office space and give each of the various departments a separate office. The change is said to make an extremely attractive and businesslike office, and to greatly facilitate the trans-

action of business. Realizing that the principal point of a jobber's and manufacturer's success lies in prompt and satisfactory shipments, the company has recently taken as a warehouse a building nearly as large as its present one, and is to-day carrying what is probably the largest stock of electrical supplies in the West. With its present greatly enlarged facilities, it is prepared to ship from St. Louis stock anything pertaining to the electrical supply business, thus avoiding delays that are often expensive and at all times annoying. A carefully compiled and complete catalogue for each of the departments, containing the entire line of goods handled by that department, has been issued and will be mailed on application.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 19, 1899.

633,146. Combined Generator and Ringer for Telephone. James G. Nolen, Cleveland, O., assignor of one-half to Charles B. Arthur, Cleveland, O. Application filed June 30, 1898.

This apparatus comprises a signal-current generator provided with one or more field magnets, a supporting frame adjustably secured to one of the magnets, a ringer mechanism, the field magnets of which are arranged within the supporting bracket, and connections between the ringer magnets and the legs of one of the generator magnets.

633,147. Tablet and Index. James G. Nolen, Cleveland, O., assignor of one-half to Charles B. Arthur, Cleveland, O. Application filed June 30, 1898.

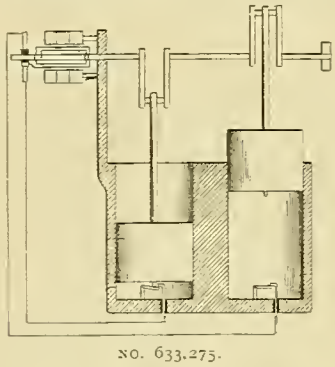
The combination with a telephone generator box open at one side, of a series of metallic tablet holders detachably hinged one with another, the inner holder forming the door of the box, marginal flanges formed upon both sides of the holder, and tablets detachably arranged within the flanges.

633,164. Electrotherapeutic Bath. Henry Stanger, Ulm, Germany. Application filed July 10, 1899.

A bath comprising a tub trapezoidal in form, carbon electrodes placed the entire length of both the longer sides of the tub, and means for supplying the bath with a completely uniform electric current.

633,165. Device for Feeding Current to Electrically Driven Cars. Carl F. P. Stendebach, Leipsic, Germany. Application filed April 1, 1898.

The combination of a box mounted in proximity to the car rail, a contact point therein for a main conductor and a branch conductor, a movable contact piece to establish contact, a bell surrounding the contacts and having its lower edge immersed in quicksilver, a rotary shaft mounted in proximity to the contacts, a pivoted lever extending through the quicksilver and operatively connected to the movable contact, and means in connection with the rotary shaft to operate the lever when the shaft is turned, a lever fast on the shaft and extending in proximity to a passing car, means in connection with the car to rotate the lever, a supply contact intermediate of the rails and in connection with the branch conductor and a runner on the car to contact with the supply contact when the main contact is closed.



NO. 633,275.

633,166. Electric Railway. Carl F. P. Stendebach, Leipsic, Germany. Application filed September 19, 1898.

A contact device for electric railways is described which has underground feed and sectional conductors, and which consists of a housing tightly closed and having a vertical spindle mounted therein, insulated contacts, one connected with the feed line and one with the sectional conductor, a rotary disk fast on the spindle and having contacts to contact with the stationary contacts when the disk is turned, a horizontally extending roll projecting into the plow channel and means in connection with a roll-supporting bar to turn the spindle when the roll is acted on by the plow.

633,172. Rheostat. Charles Wirt, Philadelphia, Pa. Application filed August 7, 1897.

An electrical resistance comprising a continuous and integral length of conductor wound or folded in a plurality of elongated sections placed side by side in contact with independent heat-radiating devices engaging the long side of the respective sections.

633,173. Insulator. Frederick H. Withycombe, Montreal, Canada, assignor of eleven-twentieths to Clement Henry McLeod, Montreal Canada. Application filed February 2, 1899.

An insulator, the entire outer or exposed surface of which is in the form of a protective cushion or guard made up of small and easily broken horizontal ridges and having water channels.

633,174. Insulator. Frederick H. Withycombe, Montreal, Canada., assignor of eleven-twentieths to Clement Henry McLeod, Montreal, Canada. Application filed February 2, 1899.

The exposed surfaces of this insulator are composed of a spiral ridge or ridges adapted to form a protective cushion.

633,175. Insulator. Frederick Withycombe, Montreal, Canada, assignor of eleven-twentieths to Clement Henry McLeod, Montreal, Canada. Application filed February 2, 1899.

This insulator has a surface composed of small, easily broken protuberances.

633,176. Insulator. Frederick H. Withycombe, Montreal, Canada, assignor of eleven-twentieths to Clement Henry McLeod, Montreal, Canada. Application filed February 2, 1899.

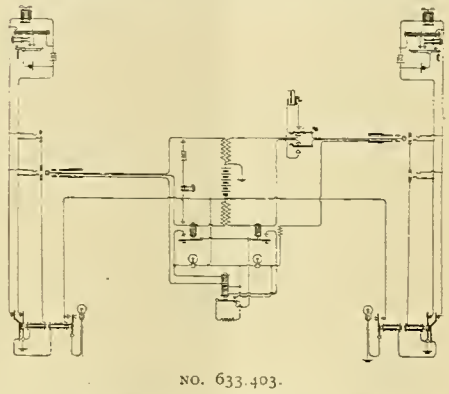
The insulator surface is divided up into small depressions and intervening portions, the latter being adapted to form a protective cushion.

633,182. Adjustable Crossover for Electric Wires. James E. Blakesley, Chicago, Ill. Application filed February 20, 1899.

The combination of an upper arm having its central portion insulated, with a metallic portion secured on the insulated part, and a lower arm pivotally secured between the insulated part of the upper arm and the metallic portion.

633,213. Wire Fence-making Machine. John C. Perry, Clinton, Mass. Application filed January 21, 1899.

A machine comprising means for holding the strand and the stay wires and means for electrically welding the wires at their point of contact, consisting of electrodes, an automatic circuit-closer and an independent automatic circuit-breaker.



NO. 633,403.

633,214. Machine for Electrically Welding Wire Fabrics. John C. Perry, Clinton, Mass. Application filed January 21, 1899.

Electric-welding devices are arranged to grasp and weld crossed wires, and means are provided for moving the welding devices to feed the wires as they weld them together.

633,218. Weighing Machine. Francis H. Richards, Hartford, Conn. Application filed November 28, 1898.

Electromagnetic means are used to magnetize a part of the material supplied to the weighing instrumentality to reduce the load, and means are provided for rendering such electromagnetic means ineffective on the poising of the load.

633,219. Thermostat Valve. George Scarfe, Tonawanda, Pa. Application filed December 16, 1897.

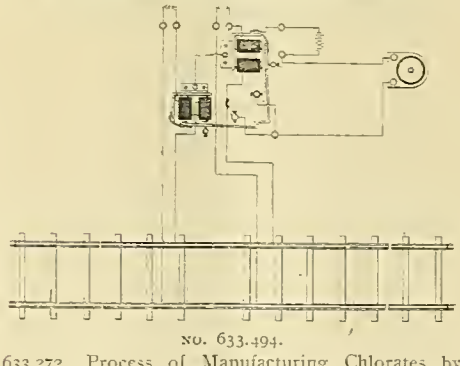
A thermostat actuates mechanism that is connected with the diaphragm of a controlling valve used in a heating system.

633,223. Electro-medical Apparatus. William P. Sutton, Toronto, Canada. Application filed November 25, 1898.

An apparatus embracing in its construction an insulated base, an electrode connected to the base consisting of a plate fitted with a series of open sockets, and conducting antifriction balls or rollers contained in the sockets and projecting slightly beyond the plate.

633,246. Device for Lighting Lamps by Electricity. Svend M. Meyer, New York, N. Y. Application filed November 30, 1898.

A lamp mount is constructed with suitable recesses or chambers in combination with batteries inserted therein, and a manually operated electric-lighting device is carried by the lamp and connected with the batteries.



NO. 633,494.

633,272. Process of Manufacturing Chlorates by Electrolysis. Thomas Parker, Tettenhall, England. Application filed December 22, 1897.

A current of electricity is passed through a solution which is covered with a layer of some buoyant non-conducting material, whereby the gases disengaged are scrubbed, the current density during the operation being maintained at about 20 amperes per square foot.

633,275. Means for Electric Ignition for Vapor Engines. Carl C. Riotte, New York, N. Y., assignor to the C. C. Riotte company of New York. Application filed January 6, 1899.

In a vapor engine are combined a plurality of cylinders, a piston moving in each cylinder, a sparking device for each cylinder embracing a pair of electrodes, an independent circuit for each pair of electrodes, a dynamo having a rotating shaft and means to drive the same, an armature coil carried thereby and forming a part of each circuit, a commutator having a segment electrically connected to the coil and carried by the shaft, a brush for each circuit for each set of electrodes and in contact with the armature, the segment being adapted to make and break an electric circuit with the proper set of electrodes at the proper time. (See cut.)

633,385. Means for Transmitting Power from Axles to Bodies of Railroad Cars. Louis T. Mann, Chicago, Ill. Application filed December 10, 1898.

A shaft in the car body is driven by bevel gearing connected with the truck axles of the car, and this shaft is in turn geared to a second shaft which operates a dynamo or other mechanism.

633,403. Telephone-exchange Switchboard Signaling Apparatus. Thomas C. Wales, Jr., Newton, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed January 23, 1899.

The system combines two telephone-substation circuits united by switch apparatus at a central station for through communication, a switch at the substations of the circuits controlling the electrical condition thereof, a supervisory signal at the central station associated with the through circuit, and two relays one for each component circuit, both controlling the supervisory signal and responsive each to the action of the switch at the substation of its respective component circuit. (See cut.)

633,432. Combined Telephone-desk and Directory Support. Samuel H. Dodd, Jeannette, Pa., assignor to Samuel Barcley Bishop, Pittsburg, Pa. Application filed December 7, 1898.

The combination of a support adapted to be positioned at one side of and apart from a telephone, a desk attachment removably sustained by the support, and means for securing the desk attachment to the telephone, thereby holding the attachment immovable.

633,471. Weight and Pressure Indicator. Edward McGarvey, Bellefonte, Pa., assignor of one-half to Guy C. Linn, Cleveland, O. Application filed April 14, 1898.

The indicator comprises a vibrating strip or ribbon having connection with a weight or pressure device, an electric circuit, an indicating device, and an interrupter in the electric circuit, whereby the undulating current will vibrate the ribbon or strip, and whereby such vibrations will be repeated at the indicating device.

NO. 633,547.

633,478. Combined Electric Motor and Pump Head. Robert J. Northam and George E. Nolan, Los Angeles, Cal. Application filed December 20, 1898.

A suitable frame and a pump shaft journaled in the frame are combined with an electric motor secured to the frame and the shaft of the motor having mechanical connection with the pump shaft.

633,494. Electrical Railway Signal. Judson Shoecraft, Topeka, Kan., assignor of one-half to C. C. Gardiner, Topeka, Kan. Application filed November 21, 1898.

There are combined with separate track sections a pair of relays having the free ends of their armature disposed in proximal relation, the free end of one armature being provided with a terminal hook, and the free end of the other armature being provided therein with an elongated eye, having a separable interlocking engagement with the terminal hook, a fixed contact for each of the armatures, a bell or alarm circuit including therein both of the contacts and both armatures, and separate local circuits for the relays respectively including the rails of the separate track sections. (See cut.)

633,516. Centrifugal Electric Switch. Robert L. Hunter, Minneapolis, Minn., assignor to the American Signal and Power company of Minnesota. Application filed January 18, 1898.

An explosive engine and its electric igniter are combined with a dynamo-electric machine operated by the engine, a battery, the dynamo and the battery each having a terminal connected with the igniter, a common return including a spark coil, and an automatic centrifugal switch interposed between the common return and the battery and dynamo, whereby either may be connected with the common return to complete the circuit of the igniter.

633,544. Electrolytic Apparatus for Precipitating Metals. Harry S. Badger, Denver, Colo., assignor of one-half to Charles W. Caryl, Denver, Colo. Application filed February 17, 1899.

A precipitating tank is described which comprises a tank body having a mercury-coated surface in its bottom, a revoluble hollow shaft suspended in the tank and provided with hollow arms having perforations on their lower sides to deliver air or vapor in proximity to the surface, means for rotating the revoluble devices, means for introducing air or vapor to the hollow shaft and its connections, and an electric circuit in which the hollow-shaft agitating arms and mercury-coated surface are located.

633,547. Telephone System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Manufacturing company, Chicago, Ill. Application filed February 6, 1899.

The combination with a telephone line extending in two limbs to the central station, of an annunciator thereat having two coils, one connected between each limb and a third conductor, the coils being wound to coact when currents are sent over both limbs through the annunciator to the third conductor and to neutralize or oppose each other when current passes from one limb through the two coils in series to the other limb, a battery or source of current adapted to be connected in circuit to send current from one limb to the other through the two coils in series, and means for permanently polarizing the core of the annunciator whereby the annunciator responds to calling currents sent over one or both limbs to the third conductor while remaining irresponsive to the battery current. (See cut.)

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, OCTOBER 7, 1899 No. 15

Electric Cabs in Chicago.

Although it is over eight years since the first electric carriage appeared on the streets of Chicago, the manufacture, sale and use of electric vehicles, as an industry, is of comparatively recent date. The horseless carriage has apparently secured for itself a secure footing, and while the days of the horse are hardly "numbered," still it may be said that the automobile has entered his field.

Although there are vehicles on the market propelled by gasoline, kerosene and steam motors, the electrically propelled carriage seems to have found greatest favor in Chicago At present there are two large manufacturing establishments in the city which are devoted exclusively to the manufacture of electric vehicles. From these concerns and others outside of Chicago have come a number of carriages and delivery wagons which are owned and regularly used by individuals and business houses in the city. But it is to the use of electric vehicles in public cab and livery service that the greatest amount of attention is now being paid in Chicago. The electric carriage has proven very popular wherever it has been introduced in livery service in competition with horse-drawn vehicles, and in New York especially, where it has been in successful operation for some time, it has become a familiar object on the street.

Where 20 years ago the horse-drawn street cars afforded practically the only means of meeting the demand for rapid transit in cities, the public is now able to travel farther, faster and more cheaply, by the use of electrically propelled cars. In the same way, it has been predicted, will the electrically driven vehicle gradually supplant the horse-drawn cabs or other vehicles now used for public hire; and drawing the parallel still closer, it is claimed that by the use of the electric vehicle the public cab service will be improved and popularized; that is to say, cab companies will be enabled to offer their patrons more rapid means of transportation at cheaper fares and still operate at a profit.

The Illinois Electric Vehicle Transportation company is the first concern to enter the field of electric-cab service in Chicago. This company has been incorporated under the laws of the state of Illinois, to operate electric vehicles in Chicago and throughout the state. It is the authorized licensee of the Electric Vehicle company, controlled by the Whitney-Widener-Elkins syndicate, and formed to operate cab systems in all the large cities in the country. The Illinois company has secured the Leroy Payne property at 172-175 Michigan avenue, on an 81-year lease, for its main charging station and storage room, and has been operating its cab service from these headquarters for over three weeks

The building, which has been occupied as a livery stable for years, has a 105-foot frontage on Michigan avenue and is 175 feet deep. It is two stories in height with a basement. The company purposes to remodel the building throughout and transform it into a modern structure that will be in keeping with the neighboring buildings on Michigan avenue. Plans are now being drawn which call for a model up-to-date station. The front will be altered and remodeled; the main floor will be lowered three feet, so as to make access to the street easier, and the alley back of the building will be paved to afford an entrance in the rear in case of a blockade on Michigan avenue.

Storage for the vehicles will be provided by the first floor and part of the basement. A storage-battery room, 38 feet in width, 171 feet long and 12 feet high, will be equipped in the basement, with provision ultimately for 250 40-cell batteries. An eight-panel switchboard will be equipped with the necessary instruments. At present the batteries are charged on the south side of the first floor, but it is the plan of the company to do all the charging in the basement eventually, the batteries being removed from the vehicles when exhausted and carried to the battery room by means of an electric traveling crane and three electric elevators. This plan is now being successfully used in the cab station of the Electric Vehicle company in New York city, the time of removing an exhausted battery and replacing a fresh one being about 40 seconds. For the present this changing of batteries will be done by hand, the operation taking from two to three minutes. Later, when the business demands it, an apparatus similar to the one in use in New York will be installed.

On the second floor will be fitted tire and light-repair shops, stock rooms, the general offices of the company and quarters for the drivers, which will include general lounging and reading rooms and

FIG. 1. ELECTRIC CABS IN CHICAGO —ILLINOIS COMPANY'S HANSOM.

a bath room. Heavy repairing and forging will be done in rooms provided in the basement. Room will be afforded for 200 vehicles when the changes now contemplated are effected. An electric elevator, of four tons' capacity, will be used to transfer the vehicles between the different floors. As is now done in the station of the parent company in New York, the Illinois company proposes to keep on hand 50 per cent. more batteries than are required for the vehicles. The exhausted batteries will be charged at convenient times, and whenever a vehicle leaves the station it will carry a fully charged battery. About two hours is required to charge an exhausted tray of cells.

In selecting the Michigan avenue site for the central station the officers of the company studied the question very thoroughly and looked at about 45 different pieces of property before finally deciding on the one chosen. It was necessary to secure a location which would be as near as possible to the center of the city; that is, to the business and traffic center. An important consideration, which had to be taken into account, and which really entirely determined the location, was the factor of "dead mileage."

It can be readily seen that with a location less central to the principal buildings, theaters and boulevards, a considerable item of expense would be entailed by the unremunerative expenditure of power in traveling to different localities in answer to call by patrons. As an illustration, suppose the present location to be actually the center of the city from the electric-vehicle company's point of view. If the station had been selected, say, 2,500 feet farther away, it would have caused an average loss of one mile a day for each vehicle, and with 200 carriages in use, a total of 200 dead miles would be traveled in one day, which would cause a loss of probably thousands of dollars in a year's time.

This question of dead mileage may be likened to the loss on electric power-transmission lines. The company realized that this dead mileage was to be avoided as much as possible, and in selecting the Michigan avenue site it believes that it has a location where the dead mileage will average less than any other, with the added advantage of being very convenient to Michigan and Jackson boulevards.

As soon as the plans of the company mature, it is the intention to establish sub-stations in different parts of the city, where public vehicles may be hired and also where supplemental charging may be done for the vehicles from the main station. The location of these auxiliary stations will depend on the demand for the vehicles in the outlying districts of Chicago, and the question of dead mileage will also enter into the selection of the sites. As the business grows, it is intended to have from seven to 10 of these stations in different parts of the city. First, there will probably be one established on the North Side, in the vicinity of North avenue, and one somewhere south of Thirty-ninth street, on the South Side. Eventually there will probably be a sub-station situated in Evanston. These stations will have a total capacity of from 100 to 150 vehicles, and with the plans now contemplated for the main station, it will mean that more than 300 vehicles and 400 drivers will be employed by the company.

At the present time the company is carrying on a simple livery business, but later on it intends to establish a regular hack-route service, and eventually will go extensively into the business of delivering parcels and packages.

There are now at the company's station 12 hansoms, five broughams, two stanhopes, one trap, one surrey and one runabout. These vehicles are in use nearly constantly and may be seen at almost any time upon the streets and boulevards of the city. The basis of charge for the cabs is 50 cents for the first mile and 25 cents for each mile thereafter, for the hansoms and single-seated broughams. The other rates are in proportion to the above. As a whole, the fares charged are less than the regular cab rates charged for the horse cabs, and the user has the additional advantage that the electric vehicle can make much better time than the old-style cab. The carriages now in use by the company are, it is said, able to run from 10 to 16 miles an hour, and a distance of from 20 to 25 miles may be traveled by a vehicle on one charge of the battery, the length of the trip being, of course, dependent on the condition of the road traveled over and the wind, which is a very important item.

By the first of November the Illinois company expects to have in addition to its present equipment 10 hansoms, 25 broughams, one stanhope, two runabouts, two lady's shopping victorias and two large victorias. These are now all ordered, and most of them are completed and on the way. It is expected to have fully 100 vehicles of various types in operation by January 1st, and besides the varieties mentioned, these will include landaus and opera busses. The vehicles are being manufactured in Hartford and New Haven, Conn., by the Columbia and Electric Vehicle company, and are being delivered at the rate of about four or five a week. The motors for the vehicles are being manufactured by the Siemens & Halske Electric company of Chicago, and the storage batteries by the Electric Storage Battery company of Philadelphia.

Fig. 1 is an illustration of one of the company's hansom cabs. Fig. 2 shows a trap with seats for four persons. The hansoms and broughams are all steered by means of the rear wheels, the motors and gearing being mounted on the front axles. The stanhopes, runabouts and smaller vehicles are guided by means of the front wheels and have the motor mounted on the rear axle. Single "torpedo" motors of two horse power rated capacity are used, and are differentially geared to the wheels. On the larger vehicles two of these motors are mounted together. Although only rated at two horse power, the motors are capable of being overloaded for short periods by nearly 100 per cent. In the larger vehicles the batteries consist of 48 cells with a 75 ampere-hour capacity, while the smaller cabs and private vehicles carry batteries of 44 cells each. The hansom cabs weigh from 3,700 to 4,000 pounds each, while broughams weigh about 200 pounds less. Each carriage is richly upholstered and is fitted with incandescent lights.

FIG. 2 ELECTRIC CABS IN CHICAGO —ILLINOIS COMPANY'S TRAP.

During the first two weeks of the company's operations the income from each cab averaged from 30 to 40 per cent. higher a day than the income from the New York cab service. This may be in part due to the curiosity and interest shown by the public, but it indicates that the electric-cab service in Chicago is destined to become an important competitor of the old horse cab. There are said to be in use in Chicago 900 old-style cabs in "hacking" service and 1,200 cabs and carriages in regular livery business, making a total of 2,100 horse-drawn vehicles for hire, these figures not including busses or carryalls.

The Illinois Electric Vehicle Transportation company, in installing its cab system, states that it intends to popularize the service as much as possible and will endeavor to furnish the public with transportation facilities such as can be obtained through no other means. Referring back to the parallel of the electric street car, one finds that the difficulties and problems to be overcome by electric-cab companies are not nearly as great as those which had to be solved before electric traction became a success. When Sprague first ran his electric car on the streets of Richmond the electric motor was probably the greatest problem he had to face. Now the motor has been improved and developed, and its use and adaptability are not questioned. The storage-battery problem is becoming less perplexing, although the weight of the cells is still a drawback.

The electric side of the question seems to be comparatively simple, and the most serious problem that remains for the electric-carriage manufacturers and users to face is the tire problem. Expense and durability may be said to be the most important items entering into the selection of a satisfactory tire. A solid tire is said to give only about nine-fourteenths of the mileage and speed that a pneumatic tire will give, and of course the latter affords more ease for the occupants and is also easier for the batteries. Contrary to the commonly accepted belief, the greatest cause for trouble with the pneumatic tire on heavy vehicles is not puncture, which amounts to but about seven per cent. of the troubles, but results from the internal wear of the fibers of the tire due to the weight. Some tires, after being used for a while, upon being examined, are found to have the fibers of the material reduced to a fine powder. The Illinois company has been using large pneumatic tires on the rear wheels of the heavy carriages and solid tires on the front wheels. It is probable, however, that hereafter the company will use the pneumatic tires entirely for the public cabs.

Power for charging the batteries is furnished to the main station by the Chicago Edison company. The substations will receive power from the wires of the Edison company or the Commonwealth Electric company, according to whichever is the handier. The voltage of the charging table runs from 108 to 125 volts.

Cab systems similar to the one in Chicago are now being successfully operated in New York city, Philadelphia and Boston. The parent company has 4,000 vehicles under construction which will be put into operation as soon as completed. The Illinois Electric Vehicle Transportation company is capitalized with $25,000,000 worth of assessable stock, five dollars having been paid in on each share. Although another payment of five dollars was called originally for October 2d, the stockholders have been granted the privilege of waiting till next February to make the payment. The following-named gentlemen are the officers of the company: President, Samuel Insull; vice-president, C. F. Kimball; secretary and treasurer, C. B. Rockhill; superintendent, W. L. Githens.

The Copper Market.

There seems to be no prospect of a weakening in the price of copper for months to come. Late quotations are from 18 to 20 cents a pound, with a brisk demand from electrical and other industries. In relation to the many new copper-mining companies recently floated, the New York Sun has this to say: "The present successful copper mines sank a great deal of money and made many costly experiments before they were able to produce copper at the figures shown on their cost sheets in 1899. New copper properties have been floated in large numbers lately, but as from two to three years is necessary to develop them and obtain a regular production from new sources, it will be some time yet before many of the new copper enterprises are established on a good producing basis. It is to be feared that many of them will never come within a mile of doing so well as their prospectus predicts. If the 30 odd new copper properties put on the market during the last 18 months produce on an average 3,000,000 pounds each annually it would be enough to disturb seriously the equilibrium between supply and demand and cause a big decline in market value. If they cannot produce this quantity in the aggregate it looks as if the share valuation of the new enterprises were terribly inflated, as it will be necessary to make a fair output if many of the concerns are ever to become worth the subscription price, to say nothing of the market price, some of the stocks are bringing."

Women's Management of the Automobile.

One reason for the popularity of the automobile is that it lends itself more readily to the guidance of a woman than do horse-drawn vehicles. Women's driving has never been taken very seriously, and very few of the sex are confident of themselves when handling the reins over a horse of any spirit. But the inanimate mechanism cannot shy or bolt, never gets nervous from flies or other annoyances, never stumbles, stands without hitching, doesn't break its harness, and in all ways commends itself to the ladies. Of course, one must be taught how to manage the vehicle, but with improvements constantly making in the direction of simplicity this should be no great difficulty to a woman of fair intelligence who can dispossess herself of the awe of the intricacies of a supposed elaborate piece of mechanism. And in the crowded thoroughfares of cities drivers will still be required to use a degree of caution and good judgment under the new order. But, making a fair comparison, it is evident that the advantages of the new vehicles for the use of women are real and great. A recent writer in the Chicago Record takes a rosy view of the prospect:

"For these thousand years," says he (or, more likely, she), "or more a certain weakness of my lady's wrists has forced her to sit quietly at my lord's side and see him hold with superior strength the reins that guide his high-steppers. And if that strength failed what could she do but scream? Some there have been who have driven, and yet no woman ever yet, deep in her heart, quite lost the lurking fear of the bit in the teeth nor overcame entirely her suspicion that the harness would break.

"But with the coming of the new vehicle, with its smartly curving handles, all this is changed. A woman can drive now, and turn and race as well as a man. It needs only the strength of a child. And, more than that, she can stop—stop wherever and whenever she pleases, and in any one of four or five different ways. And when she goes in to call or shop she has no need to worry about William and the horses. She knows of a certainty that her carriage will remain exactly where she left it, and that it cannot start until she inserts the little brass key which she carries with her.

"Moreover, she is emancipated from trolley cars and suburban railroads. If she lives in the country, 40 miles out, no more will she arise in the dawn to catch the fast train to town and worry all day about getting herself and her bundles to the fast train at night. She is ready when she pleases best; her carriage is never eating like horses, nor warm like horses, never casts a shoe, and she gets in and rides to town on 20 cents' worth of gasoline or electricity (her fare on the suburban train would have been 49 cents); she shops where she pleases, locks her bundles under the seat, waits for lunch at her favorite restaurant and stops for her husband at the office, and they spin home together in the cool of the afternoon, faster than the trolley would carry them, with no jostling or crowding and no changing of cars.

"Any woman can learn to operate a motor vehicle in an hour; she can become proficient in half a day; in two days, she can go anywhere, even in crowded streets. It isn't half as difficult to 'drive' a motor carriage as it is to learn to ride on a bicycle. The main thing required is presence of mind; a driver must know instantly which lever to pull to meet each emergency as it presents itself. A motor vehiclist must exercise the intelligence of the horse, and no mean intelligence it is, as well as that of the driver. The training, therefore, is more that of the mind than of the hands. There are only five things to learn at first—how to start, how to increase speed, how to use the brake, how to turn off the power and how to ring the bell. All these operations are performed in most vehicles with two hand and one foot lever; and they are no harder to understand than a sewing machine."

Woods Motor Vehicle Company.

The Woods Motor Vehicle company has recently completed its organization. It is incorporated under the laws of New Jersey, with a capital stock of $10,000,000, and is the successor of the Fischer Equipment company. The Fischer plant at 110-120 East Twentieth street, Chicago, has been purchased by the company, and the five-story building at 547-551 Wabash avenue has also been secured. These buildings will be used to manufacture electric vehicles of every description under the patents of C. E. Woods. Factories are also to be erected in New York city and Canada. The Chicago works are to have a capacity of 100 vehicles a month, and it is said that there are orders on hand to keep the plant busy for several months.

The Woods company is planning to start a cab service in Chicago within a short time, which will compete with that of the Illinois Electric Vehicle Transportation company. One hundred cabs will be put into service, and it is said that 35 are now ready for use. A central location will be secured for the station, and regular cab rates will be charged.

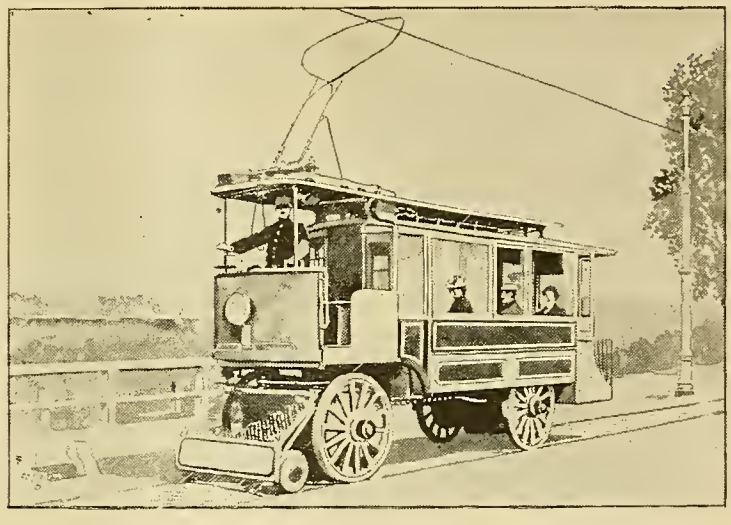
A cab service is now being operated by the Woods company in New York city with a few vehicles, and it is the intention of the company to place 200 electric vehicles in use there. Arrangements are being made to establish cab systems in other cities. In Buffalo 50 vehicles will be installed, in Pittsburg 15, in St. Louis 25 and in Minneapolis about 30.

At a recent meeting in Chicago the following-named gentlemen were elected officers of the company: President, Frederic Nicholls; vice-presidents, J. Wesley Allison and A. E. Ames; secretary, A. E. Chandler; treasurer, G. H. Atkin; general manager, C. E. Woods. The board of directors is composed of the following-named gentlemen: John W. Mackay, president Commercial Cable company; August Belmont; Dr. W. Seward Webb, president Wagner Palace Car company of New York city; Frederic Nicholls, president of the Canadian Northern Railway company and the Canadian General Electric company; George A. Cox, president of the Bank of Commerce, Toronto; Sir William C. Van Horne, chairman of the board of directors of the Canadian Pacific railroad; W. D. Matthews, director of the Canadian Pacific railroad; H. P. Dwight, president of the Great Northwestern Telegraph company, Toronto; A. B. Ames, president of the Imperial Life Insurance company, Toronto; J. W. Flavell, Toronto; J. Wesley Allison, New York; Charles Miller of the Standard Oil company, New York; H. A. Ware, vice-president of the Northwestern National Bank; C. E. Woods, Godfroy H. Atkin and Benjamin V. Becker of Chicago.

Berlin Automobile Exhibition.

The International Exhibition of Motor Vehicles recently held in Berlin attracted much attention in Germany and on the continent. The government displayed great interest in the exposition. General Lieutenant von Podbielski, the secretary of the Imperial Postoffice, accepted the presidency of the exposition committee.

The exposition was arranged in seven departments: Private carriages, cabs, omnibuses and coaches; trucks and other vehicles for the transportation of goods; motocycles and attachable vehicles; motors and accumulators for automobile vehicles; wheels and framework for motor vehicles; carriage lamps, outfits, clothing, tools and various conveniences; printed matter, drawings, plans and models, and machinery for the manufacture of motor vehicles. There were 150 vehicles displayed, representing all the best-known types in use in Europe. There were no American exhibits.



BERLIN AUTOMOBILE EXHIBITION.—COMBINATION CAR AND AUTOMOBILE.

One curious vehicle, made by Siemens & Halske, is represented in the accompanying illustration, for which the Western Electrician is indebted to the Chicago Tribune. It is an electric omnibus, made to run on car tracks with current from an overhead conductor or independently on the pavement of any street by a storage-battery equipment. A Tribune correspondent, writing from Berlin, says that the vehicle was designed for use in certain parts of Berlin. It is fitted with this firm's well known overhead-contact device, and can run on the rails as a street car or on any ordinary pavement as an omnibus. The accumulators are charged, it is said, while the vehicle is running as a street car or is at a halting place. The motorman can enter or leave the car tracks without wasting a minute, all that is required being to raise or drop a third pair of wheels. These wheels are small compared to those which bear the weight of the car and are grooved like car wheels.

The Siemens & Halske omnibus has been given only a trial trip so far, but it stood the tests so well that it may be introduced on several suburban extensions of street railways and in parts of Berlin where tracks are undesirable.

Describing briefly the technical features of the electric vehicles shown at the Berlin exhibition, a German electrical journal notes that the storage-battery cells are of ebonite and that they are usually placed under the seats or in a separate box behind. Series motors are the rule. Usually one motor is employed, driving on the rear axle, but some vehicles have two motors, one at each of the front wheels, and one large omnibus was arranged with a motor for each wheel. Spur gears for the smaller carriages and chain connection for the larger ones seemed to be the accepted practice, the ratio being one to 10 or one to 15, and occasionally one to 20. Regulation of speed is usually effected by changing the arrangement of the groups of cells in series and parallel. Forty is the number of cells frequently employed, and these are divided into four groups, connected in parallel at the first notch of the controller, two in parallel and two in series at the second notch, and all in series at the third. A fourth speed can be attained by switching the two sides of the field magnets in parallel. Besides a short-circuiting brake, all vehicles shown have either shoe or band-brakes worked by the foot. Ball bearings are employed and solid or pneumatic rubber tires. Steel tubes are used to a considerable extent, both for the frames and for the spokes; for the latter also wood and, less frequently, steel wire as on bicycles.

Electric Automobiles.[1]

By Elmer A. Sperry.

The electric automobile, coming upon the scene at this time, falls heir to many of the rich results worked out in connection with tramway traction. There are many who go so far as to predict that the younger claimant will displace the former, especially the lighter class of street-car service, and this doubtless will be the case to a degree.

Electric railways are rapidly reaching out with wider radii of operation and heavier and heavier equipment, and the automobile will doubtless have wide use as supplemental to the heavier systems. In fact, co-operation has already been proposed in a number of instances. Its great flexibility and independence of track render it the ideal urban conveyance.

As the perfection of the electric motor gave the first impetus to electric-tramway traction, so the point now reached in the perfection of the storage battery will yield equal results in the field of the electric automobile. The past three years have advanced the art remarkably, and drawn to it the attention of both skill and capital, and results have followed.

The perfected storage battery presents some remarkable features. It even rivals the electric motor in its fitness and special adaptability to the automobile problem. Its very large reserve power at instant command, its entire freedom from danger when fully charged, its almost constant pressure throughout its capacity, its recently developed capacity for quick charging, and ease with which charge may be obtained in almost any hamlet in the country, are among its advantages.

The recent claim of one maker that batteries light enough for traction purposes would live through 5,000 full discharges is hardly credible, though the negatives of some special types seem to indicate a near approach to this figure. The engineer is at present engaged in increasing the life of the light positive, with every indication of success, at least beyond the point insuring commercial requirement.

It has been supposed that compressed air is the ideal stored power, but it is safe to say that electric storage distances it in the important features. Compressed-air reservoirs weigh about 85 pounds per cubic-foot capacity for air at 2,000 pounds pressure to the square inch, the air itself weighing nearly 11 pounds. How many horse power hours will this cubic foot develop? Those who know are reticent. It is found that by adding to the air a large quantity of heat, at extra cost, by compounding cylinders and using pressure reducers and wire-drawing valves, all with added weight, that about .27 of a horse power hour may be obtained. We know that this weight of storage battery will de-

1. Paper read at the general meeting of the American Institute of Electrical Engineers, Boston, June 28, 1899.

velop 1½ horse power hours, requiring no reducing valves and maintaining its pressure practically at one point until exhausted, rather than gradually exhausting the pressures, as with air. This straight line of discharge of the batteries is not matched by any other storage system of which we now have knowledge.

Should the pavements ever be so improved as to render the rubber tire unnecessary, would the steel tire do the work? The bearing of this question upon the heavier class of automobile drays, vans, etc., led the author to cause trials to be made touching this subject. Tests were made with a vehicle, having two driving wheels, supplied with smooth wide-faced steel tires, 72 inches in diameter, car-

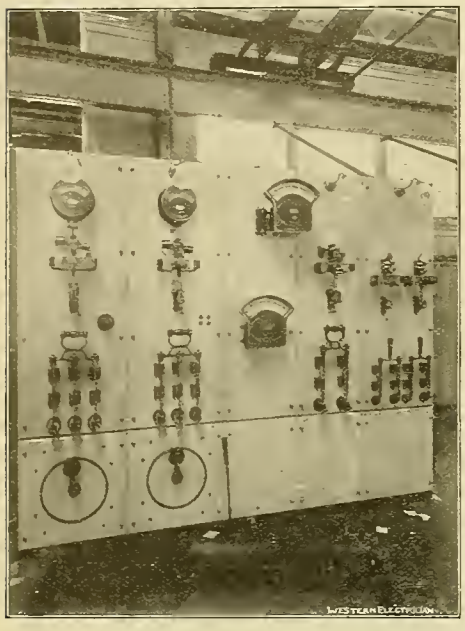


FIG. 1. A DIRECT-CURRENT SWITCHBOARD IN ENGLAND.—FRONT OF THE BOARD.

rying 60 per cent. of load. The approximate draw-bar pull was ascertained on various kinds of pavement, dirt and gravel roads and macadam, on the level and on grades, wet and dry. It was found that under the most adverse circumstances, ample adhesion could be relied upon for any conditions liable to be met. Soapy and greasy Belgian block pavement was found to give most trouble, but even here 20 per cent. draw-bar pull could easily be relied upon, with some, but not serious, slipping.

A lasting impression of the adhesion and value of smooth tires for road traction is made by seeing a vehicle of this kind ascending a 20 per cent. grade on an ordinary gravel road and rising easily uphill over a four-by-four-inch timber, placed in front of first one and then both the driving wheels, working as well on the wet portions as on dry.

The designer of the automobile is confronted with some practical problems which have not received attention at the hands of the railway engineer. For instance, in the simple matter of rendering the vehicle directible and easily controlling the guiding mechanism. Especially is this true in so arranging the parts that obstructions will not easily derange the mechanism or throw the vehicle out of its course. When one or the other of the guiding wheels encounters an obstruction of importance, the reaction works back to the guiding handle, tending to "whip" it out of the hands of the operator and throw the vehicle out of its course. (Recall the threshing of a pole or thills in ordinary vehicles.) Many attempts have been made to reduce the leverage of reaction, but at best it has remained a problem of some importance. Experiments designed to thoroughly test the practical operation of the device employed by the author show that the amount of side-thrust transmitted to the guiding handle was practically in proportion to the leverage measured by the distance between the steering axis and the plane of the wheel, at the height of the point of interception of the obstruction. A 20-inch controlling handle was connected for equal angular movement with the swiveling axles, the wheels being the same diameter, viz., 32 inches, and loaded with the same weight, viz., 370 pounds. A small obstruction causes so flat a trajectory curve as to be negligible. I have used, as the height of obstruction, the smallest dimension of an ordinary Belgian paving block, lying upon its side, assuming this to be the standard obstruction to be encountered by the various wheels in these tests. Operating the author's device and an ordinary one each a number of times over this obstruction, at different speeds, a moment of effort upon the handle, tending to swing it laterally, or snatch it out of the grasp of the operator, was found to be in the two cases as follows: For ordinary device, mean value for pull = 10¾ pounds; for author's device, mean value for pull = 0 pound. This shows an entirely different action under practical operating conditions.

The steering axis is made to intersect the plane of the wheel well up from the bottom or ground line, where obstructions are encountered and where they may be met "head on," and therefore entirely neutralized, as has been demonstrated, giving no tendency to deflection of the wheel in either direction.

It is also found that the arrangement gives the vehicle a quality of self-centering, or running straight forward, hands off. This, as will readily be seen, is a natural result of the obliquity of the steering axis. The wheels, when turned, in the act of guiding, describe a conic section, the lowest point of which is the straight-forward running position. Another peculiar feature is that in this action each wheel is entirely independent of the other, throwing no stress either upon the connecting or guiding rods. Another excellent effect is the result upon the tires, the act of steering tending to describe a small arc, rather than the usual twisting of the tires. This can be especially noticed when the vehicle is standing still.

This system of mounting the wheels is found to have peculiar advantages on rough roads and over obstructions, preventing entirely the reaction to the steering handle, giving entire immunity from fear of controlling handle being suddenly wrested from the grasp of the operator, and on ordinary smooth pavement instantly assuming the forward position upon being "given the reins." This feature has been employed upon a number of vehicles, both here and abroad, and is well received.

It is found with automobiles that while the best practice in tramway traction can be followed closely in the main, yet the different conditions under which the vehicles operate, weight of motor permissible, height at which the motors are mounted, enormous variation in the rolling-friction factor and other points allow of departures, which have an important bearing on the motor design and construction. For instance, with the automobile, only a small motor is allowable. This should be light and yet should deliver all the power necessary in case of emergency. It is found practical to use a motor with a somewhat increased ratio of copper to iron, which should have a high overload capacity, but, more than all, it is found that the size and weight of the motor can be greatly reduced, if the gears can be practically compounded. This is especially desirable, owing to the enormous variation in the rolling-friction factor

Obstructions and grades are encountered never met on tramtracks, and at the same time may be coupled with soft road, which, owing to the weights necessarily present, would render progress impossible, unless an inordinately large motor were at hand. At such times, often, if a few feet only can be compassed the journey can be resumed. It is under these and similar conditions that the value of the compound gear becomes apparent. One form of this gear, employed in a number of vehicles, has been found to be entirely satisfactory, increasing the leverage of the motor over the load. In case of a motor with a suitable overload factor, this gear, while only doubling the leverage, is found to compass anything that has ever been encountered in city, park and country service. Any ratio of gearing can, of course, be employed. By means of the compound gear the torque is brought up to nearly the slipping point of the drivers without overdraft of current supply from the battery. The manipulation is by a small handle, usually imbedded in the cushion at the side, it being used only at infrequent intervals. This compound gear not only enables a small motor to meet an emergency, but has an important bearing upon the storage battery, acting as a safeguard in a very important sense, preventing, as it does, inordinate overdrafts of electric current, and, in this way, enabling lighter plates to be employed, without fear of "shedding" the active material. Another feature of importance in connection with the compound gear is found to be its interlock and interaction with the controller. This feature renders the compound gear entirely successful in the most incompetent hands. The gear cannot be thrown or changed when the current is on, nor can the current be put on until the gear is entirely thrown to either one or the other of its normal operative positions. This is done automatically and without the knowledge of the operator.

Speaking again of the motor as a whole, its elevated position and the comparatively open space it occupies, when compared with street-car motors, enables the employment of ventilation. This should be designed with care, so as to prevent ingress of water and moisture. The ventilation is especially applicable to the small-sized motors, considering the heavy overloads to which they are frequently subjected.

In the hands of the non-expert, simplicity of control is found to be indispensable to satisfactory operation.

With the automobile there is one handle which always should be kept in hand, viz., the steering handle. The question naturally arises, "Why not let this handle do all the work of controlling the vehicle?" In a paper before this body, in 1894, the writer pointed out a system of tramcar control, which has since been widely adopted, in which starting, stopping, speed control and brake were confined to the operation of a single handle. This having now been classed as the best practice with tramcars, why not utilize the combination in connection with the steering handle, allowing it, by the most natural and almost trivial movements, to do the whole work of operation? In this way the entire control of the vehicle is simplified to a single handle. The direction of the vehicle is controlled by lateral movement of the lever, the vehicle going in any direction to which the handle is pointed or aimed. Depressing the handle, from notch to notch, increases the speed, and pulling up the handle, as one would draw in the reins in case of emergency, instantly turns off the current and applies powerful brakes. The intensity of the brakes is increased as the handle is further raised. When the speed has been reduced, by again lowering the handle, any of the speed notches can be readily picked up, the speed and brake being always under instant control, one hand only being engaged. It is apparent that the current manipulation to the motor and brakes requires only an imperceptible effort. In production, the controlling handle is made either to stay where placed, or is self-raising to the brake position, to suit the fancy of the owner. The controlling handle lying nearly horizontal, the "aiming" action in steering completes the almost ideal simplicity of the operation.

The controlling head is supplied with an indicator, showing at all times the position of controlling cylinder, and by touching a button on the side the handle may readily be raised for convenience of occupants, especially for getting in and out on driver's side.

In crowded thoroughfares, the brake is the most important feature of the automobile. The French authorities, in passing upon vehicles, insist upon this factor more than any other, and it is certainly the most indispensable. Whatever else the vehicle can or cannot compass, it must be possible to stop it, and that instantly, on occasion. The brake should be powerful and at least in duplicate. The carriages of which I speak are each provided with three separate brake systems.

The location of the controller beneath the footboard is found to present decided advantages in point of convenient interlock and interconnection with the brakes. The motor cannot be started without first removing all the brakes. This location gives ready access at all times and upon all sides by the hinged floor; gives a natural interlock between the controller and the compound gear above referred to and also between the controller and charging terminals, which are also here located. Numerous accidents, and even wrecks, have been caused by failing to open a special motor switch, when placing the controller in series position for charging. A simple interlock with the charging terminals entirely eliminates this danger, and, indeed, the interlocking system throughout the carriage very thoroughly protects it in inexperienced

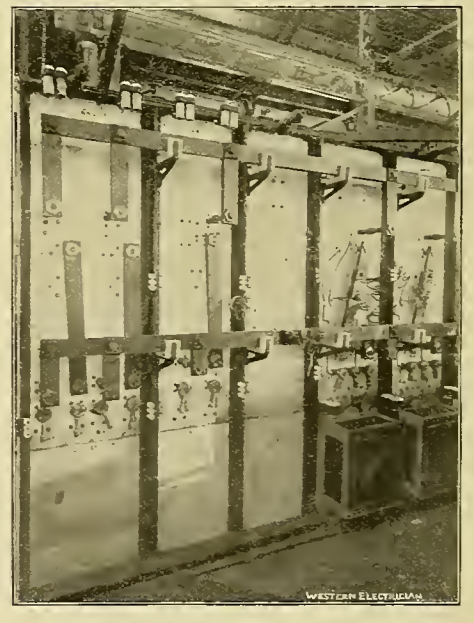


FIG. 2. A DIRECT-CURRENT SWITCHBOARD IN ENGLAND.—REAR VIEW.

hands; for instance, if the directing indicator is removed, the motor and controller are locked. If the index or pointer of this indicator points forward the vehicle will go forward. If to the rear, the vehicle will go backward. If it points upward, the carriage may be charged, but when in this position all the conductors of the motor cable are automatically open-circuited, preventing accident. The pointer can never be manipulated until the controller is first open-circuited, and if the index is only partially turned, through carelessness or otherwise, the controller cannot be operated until the mistake has been corrected.

The motor being light and small, normally should be of relatively "high speed," still farther reducing the weight. A small motor is possible with the compound gear. The double-reduction motor pos-

sesses advantages of allowing the hand-brake to be operated on the intermediate shaft, thus working through the compensating gear. A small brake, in this way, gives all the leverage necessary, being one reduction back through steel gears with small peripheral velocity, thus acting without noise. Another advantage of double reduction is in keeping all the gears of the power system small, and thus insuring a neater appearance. The somewhat higher speed permissible in the double-reduction arrangement also renders possible the bipolar motor, with its higher efficiency, as compared with the multipolar. Every condition tending to higher efficiencies should be considered in connection with automobile equipment, as conserving the resources of the battery. These conditions are not as necessary with systems of tram traction, where the prime source of power is always available.

The location of the controller and current-manipulating switches low, and in front of the batteries, avoids hydrogen detonation and eliminates all danger of explosion from spark or opening circuit.

Much has been said of one motor versus two. This is largely a matter of mechanics; it is conceded that one motor gives higher efficiency than two of half the power, and is less expensive to maintain. As even the heaviest strains are comparatively small, the compensating gear, where one motor is employed, is easily maintained, yielding a combination which is far simpler and employs less parts than with a double-motor equipment.

The automobile will, for some time, necessarily be in the hands of the inexperienced and non-expert, and while it is not possible to render it "fool-proof," yet certain safeguards may be employed in and about its operating devices and charging system which will materially reduce and almost prevent derangement. The manipulation may be so thoroughly interlocked as to effectually prevent a wrong operation preceding the right one, and rendering it nearly impossible to make a mistake in anything like normal operation. Interlocks and safety devices are used in many branches of engineering; the introduction of automatic interlocking switches is a notable example, having placed steam-railway operation on an entirely new basis. After subjecting these devices to continued practical test, and altering them until the requirements seem to have been met, the author is prepared to say that there is no reason why the important results reached in the interlocking switch and signal system should not be compassed in automobile manipulation, and by devices vastly simpler and inexpensive.

As to charging and care of batteries, it is believed that the differential-wattmeter system for ordinary use, coupled with the periodic inspection by an expert from the home office or local headquarters, is the best arrangement now at our command. The author has found that the differential factor of the wattmeter should be adjustable and should be brought from time to time into step with both the efficiency and charging curves of the battery. These curves change and are peculiarly altered by the time factors. These adjustments are easily made through determinations by the use of hydrometer. This can easily be one of the duties of the periodic inspection above referred to. The practical employment of the adjusting feature, or, in fact, any device, by means of which the meter may be left in step with the battery, is found to constitute in such a meter an almost perfect safeguard against the destructive effects of overcharge and overdischarge in inexperienced hands.

With the public conveyances, or a delivery system, operating a number of vehicles from one station, it may not be difficult to secure the services of a single expert attendant, yet for anything like commercial operation the automobile itself must be entirely successful in the hands of the "raw recruit." The driver must be a man familiar, especially at first, with the routes and business in hand. The vehicle must be depended upon to perform successfully, even under the most trying conditions, without demanding especial thought or attention on the part of its operator, who should simply be a good driver, and who, from an engineering standpoint, would be considered thoroughly non-expert.

An Automobile Excursion.

F. W. Buskirk of Chicago, assistant general passenger agent of the Erie road, is organizing an "automobile party" to make a journey to the Mammoth Cave of Kentucky. The party will be made up of eight persons, traveling in two automobiles, while a third will carry the baggage of the party. The start from Chicago will be made about October 15th, if the weather and roads are suitable. The route going will be via Lafayette, Indianapolis, Seymour and Louisville. Returning, the party will pass through Evansville, Vincennes, Terre Haute, Bloomington and Joliet.

Death of J. F. Connor.

John F. Connor, a young Chicago electrical man, died at his old home in Madison, Wis., on September 21st. Mr. Connor had been engaged in the electrical contracting business in Chicago for several years, with an office in the Monadnock building. When Electricity was published in Chicago, some years ago, he was an associate editor of that journal. Mr. Connor was well versed in practical construction work and was highly esteemed by his friends for the straightforward manliness of his character. He was 29 years of age.

A Direct-current Switchboard in England.

The design and arrangement of switchboards is not the least important of the functions of the electrical engineer, as, with the increasing diversity of the uses of electricity, the manipulation of the current assumes more complex proportions. In the illustrations on page 202, which represent a five-paneled board for direct-current lighting and power erected at the works of the Park Gate Steel and Iron company of Liverpool, England, the Westinghouse practice is well shown. This board, shown in front in Fig. 1 and in rear in Fig. 2, is for 250-volt service, but the type provides for the requirements usually arising for potentials not exceeding 750 volts. The two panels at the left in Fig. 1 control two generators, which are run in multiple; the middle panel is for the load, and the two panels to the right are feeder panels. The first generator panel is equipped with a single-light bracket, lamp and shade, an ammeter, a single-pole circuit-breaker, a voltmeter-plug receptacle and a triple-pole switch. The rheostat panel carries the resistance-box contacts and contact arms. The second generator panel provides for the operation of the other generator.

The load panel carries an illuminated-dial ammeter and an illuminated-dial voltmeter, which swing on a hinge and can be readily seen by the operator when adjusting the generators for parallel running. The first feeder panel contains a single bracket, lamp and shade, a single-pole circuit-breaker and a double-pole switch. The second feeder panel contains two single-pole circuit-breakers and two double-pole switches. As additions are made to the plant, extra panels for controlling generators and feeders can be added to the switchboard without interfering with the service.

Flat conducting bars are used to connect the different instruments and the switches mounted upon each panel. Each of these bars is of 300 amperes' capacity. For very heavy currents a larger bar is used, a ventilating space being left between successive bars. The connections for the bus-bars are arranged on each panel and can be attached without difficulty. The Westinghouse standard adjustable-jaw switches are used.

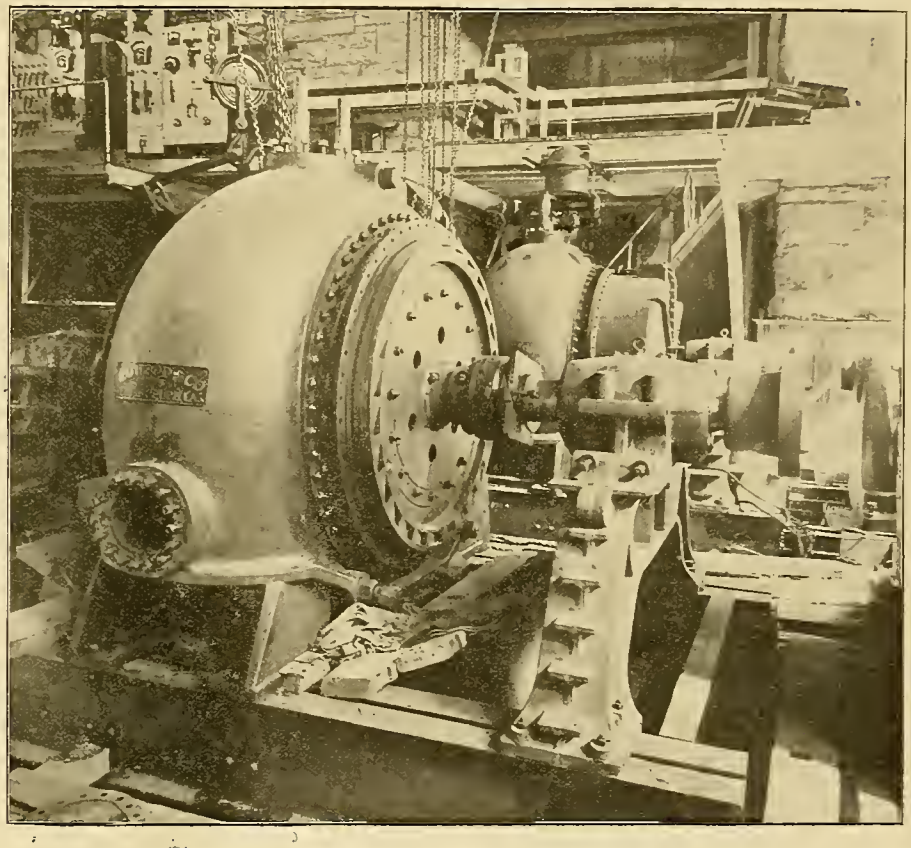
The range of the ammeters exceeds the normal rating of the corresponding panels from 25 to 50 per cent. The switches, circuit-breakers and all connections and terminals are designed to carry the currents corresponding to their normal ratings continuously for an indefinite period, and without dangerous rise of temperature will carry temporary overloads not beyond the range of adjustment of the circuit-breakers and the scales of the ammeters. The range of adjustment of the circuit-breakers varies somewhat between the different sizes, but in general the circuit-breakers may be set for any predetermined current between the limits of 75 per cent. and 150 per cent. of their normal ratings.

Fuse panels with eight fuse holders are provided when required; they can be mounted in the space below the standard panels. These fuses are supplied for potentials not exceeding 250 volts, and for currents up to 600 amperes. For voltages exceeding 250, the fuses are not mounted upon the face of the board.

Phœnix Battery Plant Released on Bond.

The plant of the Phœnix Battery Manufacturing company of St. Louis, of which Colonel S. G. Booker is superintendent, was released on a bond of $40,000 on September 26th, and work was resumed. As related in the Western Electrician last week, a United States marshal seized the plant in a replevin suit brought by the National Carbon company. The trouble grew out of the purchase of the plant of the old Phœnix Carbon Manufacturing company by the carbon trust. The case will come up in the March term of the United States court, and Colonel Booker and his associates believe that they will win it without difficulty.

Mr. Albert Blair, vice-president of the Phœnix company, is thus reported: "We admit that the factory was bought from us by the carbon trust; that is, so much of it as pertains to the production of carbons for electric lights and brushes on electric cars. We reserved the patents on machinery and patterns which were used in the production of carbons for batteries in connection with the telephone and telegraph and a line of specialties. The purchase price of the plant, $187,000, was paid over, but there was a clause in the contract of sale providing that written notice should be given when possession was desired and that six months' time should elapse from the time the notice was given before possession should be given. A representative of the trust was here and we asked him for an inventory of the machinery in the factory which they claimed under the sale. No such inventory was given, and a short time ago a representative of the company came here and demanded immediate possession. To give possession instanter would greatly hamper work in the direction of starting a new plant for the manufacture of the lines which had been reserved from the sale, and so we did it propose to be routed out."



LARGE NEW TURBINES AT NIAGARA.

Large New Turbines at Niagara.

The interior of the station of the Niagara Falls Hydraulic Power and Manufacturing company presents a busy scene. Many men are engaged in erecting new turbines and new generators in order that the factories that are enlarging may be supplied with power at the earliest possible moment. In the illustration will be seen two of the new turbines in course of erection. The picture gives an excellent idea of the construction of the wheels. Each of the turbines is of 2,500 horse power and will be operated under a head of nearly 210 feet. Each wheel is supplied with water from the penstock erected last year, the supply passing to the wheel through a 60-inch valve. The position of the two wheels shown is on the first two valves of the penstock—that is, nearest the cliff. Each wheel will be direct-connected to two generators, now being erected.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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A new incentive to sobriety has arisen, for a German investigator asserts that drunkards are more sensitive to electric shock than other persons. This writer thinks that there is danger in a shock from a potential as low as 100 volts, especially if the recipient is an inebriate. Eschew the flagon and the tankard, then, O followers of Thales, that thy days may be long in the land.

In England the Electrical Trades Union is enterprising. It advertises in the technical papers. "Have you joined the Electrical Trades Union?" it asks, in display type, addressing electrical workers in general. "If not, write for particulars to general secretary," giving the address. This is a fair, open way of increasing the membership of the union and would seem to indicate that, in furthering the interests of their union, at any rate, English electrical workmen are up-to-date.

Mischievous boys threw a bare wire over an electric-light wire in Perth Amboy, N. J., the other day and were delighted to find that they could feel slight shock. Finally, the insulation of the overhead wire became abraded, and one of the boys, who had been told to wet his hands as an extra precaution, was killed. Aside from burying all high-tension wires, it is difficult to see how such accidents can be avoided except by the precepts of parents and teachers, who should impress on Young America that "fooling" with electrical conductors of any description is taking a risk that may end in death.

Electrical decorations formed a very conspicuous feature of the Dewey celebration in New York last week. On sea and land, searchlights and incandescent lamps, the latter in almost every conceivable design, made the night brilliant in welcoming the returning admiral. The magnitude and variety of the electric-lighting effects were truly impressive. Thousands of dynamos and dynamo tenders furnished the "juice," and probably the incandescent lamps used for the illumination were numbered by the hundreds of thousands. In the "Welcome Dewey" sign on Brooklyn Bridge alone there were fully 6,000 lights. Among the other vessels, the Erin, Sir Thomas Lipton's steam yacht, which attracted so much attention in the water parade, was especially illuminated, and it is said that over 3,000 lamps were used for the purpose. The whole display was a great exhibition of the electric-lighting resources of a great city as well as a very striking tribute to the hero of Manila.

In a recent paper on "Electrical Machinery on Board Ship," Alexander Siemens, speaking of direct-connected generating units, said: "In view of the contention that English practice is lagging behind that of other countries, it is as well to remember that at the Chicago exhibition the two or three direct-driven sets were almost ridiculed by the American engineers, who confidently predicted that the old country would soon drop this practice and adopt the American method of belt driving." Later on Mr. Siemens adds that direct driving is now as much in use in the United States as anywhere else. But he underrates the extent to which direct connection had obtained in this country at the time of the World's Fair. The largest generator on the exposition grounds, built by an American manufacturer and installed in the intramural power station, was direct-connected. There were at least eight direct-connected units of 1,000 horse power or over, of American make, in Machinery Hall and the intramural station. Indeed, it is probable that so many large engine-dynamos were never assembled before.

Under the title, "The Existence of Masses Smaller Than Atoms," Prof. J. J. Thomson read a paper before Section A of the British Association last month which may bring about a change in existing views of the nature of electricity. The subject is an abstruse one; it has to do with the fundamentals of all physical sciences and all material things; but if we accept the summary and comment of the London Electrician as correct, Professor Thomson has been led to believe that "the atom of matter is not that fundamental and invariable unit of mass which orthodox chemistry and physics have long insisted upon. Indeed, to use Prof. Oliver Lodge's expression, it would seem as though electricity is the really atomic thing, and that matter is not atomic at all in the strict sense. Possibly, nay, even probably, the researches which Professor Thomson has prosecuted, in his investigations into this recondite but fascinating subject, are leading us a step farther toward the conviction that has long been growing in the minds of physicists and chemists, that the atoms of the elements are one and all built up of one simple elementary substance; that, in fact, the so-called elements are not really elementary, but are modified forms of one and the same substance, their diversified atoms being structurally different, but in substance the same as one another." This theory is difficult to grasp and hard to believe. It seems to imply that electricity is the basis of everything, "the really atomic thing." That is a stupendous conjecture. In the last analysis the one indivisible thing that remains is electricity! It is a startling thought.

It is no derogation to the other gentlemen selected to read papers before the American Street Railway association to say that the greatest popular interest will center in Mr. C. T. Yerkes' essay on "Investments in Street Railways," with its interrogative sub-title, "How Can They Be Made Secure and Remunerative?" No man in the country is better fitted to discourse interestingly on the subject assigned to him. As a "street-railway magnate," operating principally in Chicago, Mr. Yerkes is generally credited to have made a large fortune for himself and to have materially helped his friends in augmenting their store of wealth. He is a man of fine executive ability, with pronounced energy and decision of character and a conspicuous aptitude for large financial dealings. He has antagonized many people, but he made his railways pay. His methods have not escaped criticism; but no one failed to acknowledge the power and courage of the man. What Mr. Yerkes says is always listened to, with attention, certainly, and often with approval, and as he is a very busy man, and seldom appears at public conventions to enlighten his fellows from the store of his experience, the present announcement is of exceptional interest.

Canada, with comparatively little coal and large and abundant water-courses, offers a promising field for electro-hydraulic development—a field which is now being exploited with energy. There is no doubt that the numerous and increasing projects for the development of electrical energy by water power, which are now either in contemplation or in course of construction in the Dominion, are playing an important part in contributing to the prosperity and progress which that country is now enjoying. Towns and cities are growing through the agency of this factor in the commercial and industrial pursuits of the country, and the foundations of future great manufacturing centers in Canada are being laid in places where, but for the utilization of water powers for the production of electrical power, they would never have been considered possible.

Ottawa may be cited as one of the cities which will be greatly affected by the production of cheap electrical energy. Two of the largest electrical companies at the Dominion capital are even now making special offers to supply power to any new concerns which may be induced by such consideration to establish themselves in the city or vicinity. The future of Ottawa is not dependent upon the fact that the seat of the federal government is there. At her doors and within her gates there is a vast water power which is capable of furnishing hundreds of thousands of electrical horse power to operate factories and other works at very low rates. It is asserted that within a radius of 45 miles of the city fully 1,000,000 horse power is available, while 200,000 of this power is within eight miles of the heart of the city. Before the present year closes conduits will have been laid which will enable manufacturers to obtain power at almost any locality at a maximum charge of $23 a horse power per annum.

In the city of Hamilton, Ont., electrical power is coming into extensive use. Now that Hamilton has secured cheap electric power from near the Welland canal—a power which is transmitted from a distance of about 40 miles to the city—steam power seems to be gradually disappearing from the industrial establishments of Hamilton and vicinity. The province of Quebec is also experiencing a boom in electrical power development which bids fair to add materially to its prosperity and population. The development at the Shawinigan Falls, on the St. Lawrence, on a very large scale, may be cited as an example of this tendency.

To what extent electricity will influence the growth and expansion of Canada during the next 10 or 15 years can hardly be estimated, but it needs no prophet to foretell that it will be of the greatest importance in the development of the country.

American Street Railway Association

Preparations for the convention of the American Street Railway association, to be held at Tattersall's, Chicago, October 17th to 20th, inclusive, are in satisfactory shape, although, so far as exhibits go, possession of the building cannot be had until October 10th. That will still leave a week for the installation of exhibits, and everything should be in place on the opening day. All the space has been taken, and the display will be a large and instructive one. Exhibitors are advised that all goods should be marked with the consignor's name, and directed to Tattersall's, Chicago, care of H. W. Smith, successor to Anderson Transfer company, 1618 State street. Bill of lading or advice that goods have been shipped in his care should be sent to Mr. Smith, giving particulars in regard to shipment. Power in limited quantity, in the shape of 500-volt current, will be supplied by the Chicago City Railway company. The Chicago Edison company's 220-volt mains are also connected with the building.

In a general way the entertainment programme has been arranged. There will be a reception to the visiting street-railway men and the ladies, beginning at 8 p. m. on Tuesday, October 17th, at the parlors of the Auditorium Annex. This will be an excellent opportunity for the renewal of old acquaintances and the making of new ones. On Wednesday, starting at 1:30 p. m. from the Polk street station, there will be an excursion to and along the drainage canal over the Santa Fe railroad. The Chicago drainage canal is an engineering work of the greatest interest, and this trip should be one of the best features of the week. A tally-ho party for the ladies and their escorts has been arranged for Thursday afternoon. The party will start from the Auditorium about 1:45 p. m. and drive through the South Side parks and boulevards to the site of the World's Fair in Jackson Park, returning in time for dinner. On Thursday evening there will be a theater party, although the play has not been selected as yet. Friday is the great day for the exhibitors, the executive committee of the association having formally set aside that day for the systematic and careful inspection of exhibits. Therefore, there is no special entertainment feature arranged for that day. The annual banquet will be held on Friday evening and the new officers will be installed.

The special trains from the East will leave Boston at 10:30 a. m. on October 15th and New York at 1 p. m. on the same day, joining at Albany at 4:30 p. m., and arriving in Chicago at 2:30 p. m. on October 16th. The New York committee on transportation is composed of H. H. Vreeland, James H. McGraw and T. C. Martin, and Charles S. Clark is the committee for Boston. The trains will run over the Boston and Albany, New York Central and Lake Shore roads.

The Chicago committees in charge of arrangements consist of the following-named gentlemen:

General Committee.—J. M. Roach, vice-president and general manager North and West Chicago Street Railroad companies, chairman; secretary and treasurer George A. Yuille, second vice-president West Chicago Street Railroad company; George O. Nagle, assistant general manager Chicago City Railway company; H. M. Sloan, general manager Calumet Electric Street Railway company; H. H. Windsor, editor Street Railway Review; F. L. Fuller, general superintendent West Chicago Street Railroad company; James R. Chapman, general manager electrical department, North and West Chicago Street Railroad companies; T. C. Penington, secretary American Street Railway association.

Entertainment Committee.—J. M. Roach, chairman; T. M. Henderson, superintendent North Chicago Street Railroad company; A. S. Littlefield, railroad contractor; George C. Bailey, John A. Roebling's Sons company, Chicago; Harry Keegan, assistant superintendent North Chicago Street Railroad company; Frank R. Green, secretary Chicago City Railway Company; George A. Yuille; F. W. Edmunds, secretary Q. & C. company; F. S. Kenfield, business manager Street Railway Review.

Exhibit Committee.—James R. Chapman, chairman; C. E. Moore, master mechanic Chicago City Railway company; John Miller, master mechanic North Chicago Street Railroad company; F. T. C. Brydges, master mechanic West Chicago Street Railroad company; A. C. Heidelberg, assistant superintendent Chicago City Railway company; Geo. W. Knox, chief electrician Chicago City Railway company; W. A. Harding, master mechanic Calumet Electric Street Railway company; E. C. Noe, engineer General Electric company.

Transportation Committee.—F. L. Fuller, chairman; W. Worth Bean, president and general manager St. Joseph and Benton Harbor Electric Railway and Light company, St. Joseph, Mich.; William Walmsley, superintendent South Chicago City Railway company; William J. Cooke, McGuire Manufacturing company; T. D. Miles, with West Chicago Street Railroad company; J. M. Atkinson of J. M. Atkinson & Co. of Chicago; John O'Keefe, with Chicago City Railway company; H. W. Falk, president Falk Manufacturing company; Clift Wise, contractor.

Publicity and Information.—H. H. Windsor, chairman; C. S. McMahan, western manager Street Railway Journal; D. B. Dean, Terre Haute Car Manufacturing company, Terre Haute, Ind.; J. A. Hanna, Peckham Truck company, Chicago; C. J. Riley, chief engineer Chicago City Railway; John O'Keefe; A. L. Tucker, Western Electric company; James A. Brett, general manager Electric Installation company.

Halls and Hotels.—George O. Nagle, chairman; A. S. Littlefield; T. M. Henderson, superintendent North Chicago Street Railroad company; Harvey A. Higgins, Washburn-Moen Manufacturing company; F. H. Clark, Electric Storage Battery company; Robert F. Carr, manager Dearborn Drug and Chemical company; W. H. Forsythe, Forsythe Brothers company.

Banquet Committee.—J. M. Roach, chairman; D. G. Hamilton, Chicago City Railway company; M. B. Starring, assistant general counsel Chicago City Railway company; B. E. Sunny, General Electric company; H. H. Windsor; C. S. McMahan; Geo. C. Bailey.

Reception and Ladies' Committee.—H. M. Sloan, chairman; Theo. P. Bailey, General Electric company; Joseph Leiter, Chicago City Railway company; Frank R. Green; F. L. Fuller; C. K. Knickerbocker, Griffin Wheel company, Chicago; L. S. Owsley, secretary and treasurer North Chicago Street Railroad company; J. Charles Moore, secretary and treasurer North Chicago Street Railroad company; T. C. Penington; Geo. A. McKitrick, president Central Electric company; F. E. Smith, auditor Chicago Union Traction company.

Finance Committee.—Geo. A. Yuille, chairman; C. R. Penington, with Chicago City Railway company; J. Charles Moore; W. S. Bell, assistant secretary and treasurer West Chicago Street Railroad company; H. B. White, secretary and treasurer Calumet Electric Street Railway company; Fred. H. Fitch, General Electric company.

The list of papers to be read is not long, which is a good thing, as it will give time for intelligent consideration and discussion. It is as follows:

"Maintenance of Car Equipment," J. H. Van den Veer, Brooklyn Heights Railroad company, Brooklyn, N. Y.

"Modern Street-railway Shops: Their Design, Machinery and Shop Practice," B. L. Kilgour, chief electrician Cincinnati Street Railway company, Cincinnati, O.

"Train Service and Its Practical Application," Ira A. McCormack, general superintendent Brooklyn Rapid Transit company, Brooklyn, N. Y.

"Investments in Street Railways: How Can They Be Made Secure and Remunerative?" Charles T. Yerkes, president Consolidated Traction company, Chicago.

"Construction and Maintenance of Street-railway Tracks," Edward Butts, chief civil engineer Metropolitan Street Railway company, Kansas City, Mo.

League Island Dry-dock.

Washington, D. C., September 30.—The Bureau of Yards and Docks of the Navy Department is inviting sealed proposals, until October 21st, for the construction of a wooden dry-dock at the League Island (Pa.) navy yard. The work is divided into three classes, the second class, or Part B, including the furnishing and installing in place of the operating machinery and power plant for the dock, with all appurtenances. This division separates the work on the dock from everything else, and the planning and construction of the big electric plant which is to operate the winches, the pumps and other appliances can proceed without complications on account of the character of the material used in the dock.

Under Part B there are to be provided eight electric capstans and three electric winches, each capable of lifting 20,000 pounds 15 feet a minute, with a purchase of five to one, to have two speeds, and to be set in a body of concrete with proper holding-down bolts. Capstans and winches shall be reversible in operation, and so designed as to be operated by hand power, if desirable or necessary. The capstans and winches are to be operated by improved motors and controllers of street-railway type, with a speed of about 500 revolutions per minute and of power not less than 35 horse power. The motors must be provided with circuit-breakers, switches, fuses and other appliances necessary for their safe and convenient operation.

The pumping plant is to consist of three independent centrifugal pumps, with electric motors, for pumping out the dock, and one centrifugal drainage pump and motor. Two vertical cross-compound, condensing, automatically governed engines, each direct-connected to two dynamos, are to be installed in the engine house. There will be four 250-kilowatt dynamos of the compound-wound, direct-current, constant-potential, 125-volt type, arranged for direct connection with outboard bearings. There will be three 450 horse power motors, each to be direct-connected to the runner shaft of a main pump, and one 75 horse power motor, to be direct-connected to the runner shaft of the drainage pump. The motors are to be wound for 220 volts.

The switchboard in the power house will have one panel for each dynamo, one total-output panel and four power panels. Each machine panel is to have one triple-pole, single-throw dynamo switch, one circuit-breaker, one field rheostat, mounted on back of board, with handle and dial on the front, and one Weston round-pattern shunt ammeter. Three power panels are to be of 500-kilowatt capacity each, and one is to be of 200-kilowatt capacity.

A 15-ton electrically operated traveling crane is to be installed in the engine house. The speed of hoisting 15 tons shall be 15 feet a minute, with a proportional increase for lighter loads.

Prospective bidders desiring full specifications and plans can obtain them upon application to Mordecai T. Endicott, chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C. The appropriation available for the entire work is $825,000. T.

Test of Automatic Telegraph Sender.

A dispatch from Budapest under date of September 30th states that the United Electrical company, on the preceding night, tried for the first time in Eastern Europe the rapid telegraphic invention of Virag and Pollak. The test was made upon the government wires between Berlin and Budapest, and it is said that all the experiments were successful. The test showed that the messages, which had been previously perforated upon a tape, could be worked off by electricity at the rate of 78,000 words an hour, although the machine's normal capacity, as the inventors declare, is 100,000 an hour. By this system the inventors say one wire can do the work of 16 wires worked by the present method. Representatives of several American electrical companies and of the French, Hungarian and German governments were present at the tests. Although the trials were said to have been successful, it is stated through the Associated Press that the German postal department considers the apparatus too delicate for ordinary use.

Space Telegraphy at Dover and New York.

At the recent meeting of the British Association at Dover messages were exchanged across the English Channel, from Dover to Wimereux, near Boulogne, by the Marconi space-telegraphy system. In this way pleasant greetings were exchanged between the British and French scientific associations, which met concurrently, the one at Dover, the other at Boulogne. Messages were also sent from Dover to the Electrical Congress at Como, Italy, by space telegraphy; that is, they were sent as far as Wimereux by the new method and thence forwarded by wire. The results were excellent. The "Marconi pole" was erected on the tower of the Dover town hall, and the current was considerably intensified by placing at the masthead a large cage of close wire netting, cone-shaped at both ends, the metal netting having the effect of collecting the electrical waves.

An interesting effect of the Dover experiments was the effect on a near-by telephone circuit. According to the London Electrician, the facts were these: "A temporary call office with a metallic circuit having been erected at the reception room near the wireless-telegraph installation, and the wires leading to this call office passing within 10 yards of the Marconi wire from the mast on the town hall, induction effects during the transmission of wireless messages were naturally audible at the temporary call office; but it would appear that these were not detected in any part of the permanent telephone system at Dover. We understand that a similar experience was observed at Adelaide, South Australia, where Sir Charles Todd and Professor Bragg have been making experiments in Marconi apparatus between Henley Beach and the observatory, and some of the signals were clearly audible on a telephone wire in ordinary use between the postoffice and Henley Beach. These observations have a considerable practical interest, for if an earthed telephone circuit can be employed as a receiver for transmissions over useful distances, the coherer and its sluggish decoherer can be done away with and a much more rapid rate of signaling be obtained. Metallic circuits would sufficiently protect the regular telephone service from disturbance."

Marconi's preliminary experiments in New York, in making ready for the yacht-race report, are reported to have been successful. The test was between the steamer Ponce, with Marconi on board, and the station at Navesink Highlands. It was the day of the Dewey naval parade, and when the first message from Navesink was received the Ponce was in the harbor below the statue of Liberty. But as the ship moved up the Hudson River communication with the Jersey station was continued. From the anchorage off One-hundred-and-twenty-fifth street the messages sent from Navesink were received with more even regularity, it is said, than had been the case when the two stations were closer together. The vertical wire was attached to a spar lashed to the foremast of the Ponce and extended 40 feet above the mast. The boat attracted much attention during the parade, and there were cheers for Marconi. It is stated that during the yacht races space-telegraph messages will be sent from both the Ponce and the Grande Duchesse, Marconi being in charge of the apparatus on one and W. J. Clarke and C. R. Ricard on the other.

Duty of Maintaining Proper Insulation.

The demurrer of the defendant, in the case of Anderson against the Jersey City Electric Light company, established that the defendant used for its purposes wires that it had placed in a light shaft, where it knew that the class of laborers to which the plaintiff belonged would enter to work; that these wires were under the control and management of the defendant, who passed through them a current of electricity dangerous to a human being, and that it failed to maintain a proper insulation of this current, whereby the plaintiff, while working in the shaft (repairing and refitting same), was injured. In other words, the demurrer admitted, in effect, that the defendant knew that the plaintiff would enter the shaft and work in the vicinity of its wires, and that it did not use reasonable care to render them safe in view of their location, whereby the plaintiff was injured.

Such being the case, the Supreme Court of New Jersey overrules the demurrer, holding that a good cause of action was thus stated. It says that the elemental rule is that whoever uses a highly destructive agency is held to a correspondingly high degree of care. Care, in this sense, means more than mere mechanical skill; it includes circumspection and foresight with regard to reasonably probable contingencies. And the court more particularly holds that one who uses, controls and manages an electric current of high destructive power, in a place where it is reasonably probable that others must enter to work, owes to each person who so enters a duty to use reasonable care to maintain a proper insulation of such current.

The city of Saar-Union, Germany, says a Chicago Record correspondent, has erected municipal electric-light and power plants for public and private use at a cost of 150,000 marks.

DEVELOPMENT OF THE TELEPHONE FIELD.

Legal Relation of Rival Companies.

Section 103 of the transportation corporations law of New York provides that every telegraph or telephone company shall receive dispatches from and for every other telegraph or telephone line or corporation, and from and for any individual, and, on payment of the usual charges by individuals for transmitting dispatches as established by the rules and regulations of such corporation, transmit the same with impartiality and good faith, and in the order in which they are received; and if it neglects or refuses so to do, the offender shall pay $100 for every such refusal or neglect.

If there are two telephone companies doing business in a certain village, each with five miles of wire therein, but one of them without any outside connection, while the other has 5,000 miles of wire extending over the whole state, and if the latter charges an individual $15 a quarter-year for installing a telephone in his office, and allowing him to use it to send messages to any place where its lines extend, the question arises: Will this law compel this latter company to furnish the other company a telephone to send its patrons messages?

The Third Appellate Division of the Supreme Court of New York holds not, in the case of the People against Telephone company, reported in 58 New York Supplement, 221. It declares that it is foreign to the purpose of the statute to permit another corporation, under pretense of using the line of its rival for purely private business, to use it to absorb the very business to which it was intended simply to permit it to contribute and profit upon the same footing as an individual. It explains that when corporate, or even individual, property becomes, from its situation and use, employed as a monopoly of the public service, it can be regulated by statute so as to prevent extortion or excessive charges; yet to compel service at unremunerative rates is equivalent to taking private property without just compensation, or taking it from one and giving it to another, and therefore not permissible. And, assuming it to be the duty of the second company to render the like service to the first as to an individual, the court declares it to be plain that it could not be required to render much more than the like service, or, in other words, to give the first company an inequality of advantage under pretense of equality. And in case it had put in a telephone, the court holds that it could have made regulations limiting the first company to its individual business, excluding that of its customers. Finally, assuming that section 103 has changed the common-law rule as to rival companies, and imposed upon one company the duty to install an instrument in the office of another, the court says that it has also imposed the penalty for its violation, and holds that the remedy prescribed by the statute is exclusive; that the remedy is an action at law for the damages allowed by the statute; and that, therefore, mandamus to compel performance will not lie.

Independents Busy in Atlanta.

The new Atlanta (Ga.) Standard Telephone company claims to have over a thousand telephones connected in that city. It is said that the new company has already expended several hundred thousand dollars and that its entire investment may reach $750,000 before the plant is completed. Captain John W. Rutherford is the superintendent of the company. The bill asking the court to appoint a receiver for the company, which was filed in the Superior Court several months ago, was dismissed at the request of the plaintiffs themselves last month. The suit was filed by the Atlanta Trust and Banking company, trustee for the bondholders. The trustee acted upon the application of Joseph Herzog of New York and others, who claimed the company had defaulted in the interest due on some of the bonds. It was claimed by the telephone company that its books contained no record of the bonds on which the suit was based, and it was for that reason the interest had not been paid. It was also shown that a large majority of the bondholders were opposed to the receivership and had voted confidence in the management.

New York State Company.

The incorporation of the New York Telephone Incorporation of the City of New York and State of New York was noted in the Western Electrician last week. The new company purposes to supply the state with telephone service, it is said, beginning first with the leading up-state cities—Buffalo, Rochester, Albany, Syracuse and Utica. It is provided that the service may be extended to every city, town and village of the state. D. A. Reynolds of New York, one of the incorporators, in an interview said that the company would endeavor to connect all the leading cities and towns of the state at the earliest possible date. He said the company would enter into direct competition with the Bell companies, and in order to do it the rate will be considerably reduced. The new company is said to be allied with the People's Telephone corporation of New York, and will handle the business out of New York, intercommunicating with the People's in the metropolis. The first construction is to be done at Yonkers.

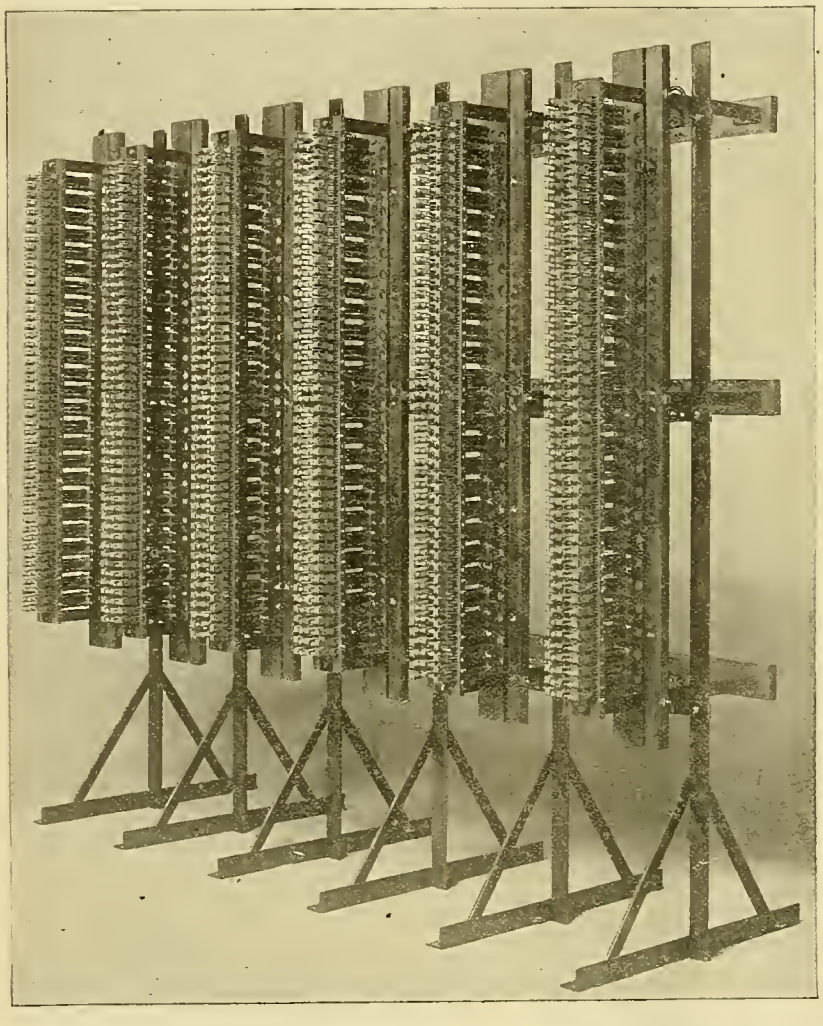
Automatic Telephone Protection.

There is probably no feature of the telephone exchange which has received so much attention during the last few years from telephone experts and engineers as the matter of protection of the central-office equipment, the cable and the subscribers' telephones. For years no protection of any sort was offered outside of the old-style carbon lightning arrester, and it is only within a recent period that apparatus has been offered to the telephone public which is automatic in the protection of this equipment, cutting out high-tension and sneak currents. For the last few years there have been different methods used which involved the use of fuses or fusible coils, it being required in these cases to replace the fuses or fusible coils every time lightning or sneak currents enter the exchange or telephone.

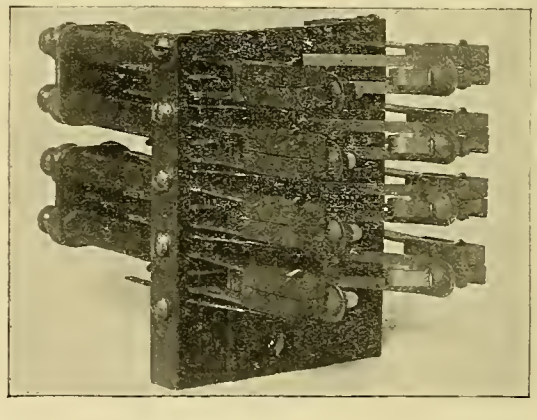
The North Electric company of Cleveland has recently brought out an apparatus which it asserts to be the only equipment that is entirely automatic in its operation. With this apparatus, when a high-tension current or sneak current gets on the line, the line is automatically cut to ground, cutting out the line drop and heat coil without damaging either. In this case, where a current gets on the line which would damage the drop, the fuse in the cable box is blown, opening the line, when the automatic cut-out at the central office automatically restores itself. An important convenience in the use of this apparatus is involved in the fact that when lightning gets on the line the fuses are not blown, the discharge being taken to ground by means of carbon lightning arrester. This equipment allows the use in a cable box of a fuse of far greater capacity than is possible with other systems of protection. In this way every little thunderstorm does not involve the expense of replacing numerous fuses or fusible coils burned out, and, furthermore, saves the time of the inspector in testing the lines and replacing the fuses or fusible coils. Another important feature is the fact that at all times during the electric storm the lines are in full working order. The method of mounting this automatic equipment on angle-iron racks in combination with a thorough and simple system of cross connection makes the system thoroughly elastic, it being applicable either for small or large exchanges.

The North Electric company says that there is no apparatus of equal efficiency and perfection offered, either in the Independent field or in the ranks of the Bell companies. An important feature of this system is the elimination of the necessity of expensive office terminals for the cables. A convenience which will be appreciated by all inspectors is the facility offered for testing the lines, either to the switchboard or to the outside lines from the cut-out rack. In this way there is combined in one piece of apparatus a cross-connecting rack, lightning arrester and high-tension current protector, office terminals and testing board—a combination which should appeal to all purchasers who are in the market for a thoroughly high-grade, up-to-date article.

The North Electric company asserts that it has had this equipment in use for some time, giving it a thorough and efficient test, and is prepared to guarantee that any exchange using its system of protection will be entirely free from damage resulting from lightning entering its exchange or from high-tension or sneak currents getting on the lines.



300-pair Equipment of Heat Coils.



Heat-coil Units.

AUTOMATIC TELEPHONE PROTECTION.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Hanason Telephone company of Deadwood, S. D., has enjoined the state treasurer from collecting $734, the taxes for 1896, 1897 and 1898. The company alleges excessive valuation on the part of the state assessment board.

J. C. Hubinger, proprietor and general manager of the Mississippi Valley Telephone company, is in Minneapolis and St. Paul, looking after the installation of the new exchanges in the Twin Cities.

The Willow Creek (Minn.) Telephone company is taking bids for constructing a line.

The telephone wires at Oshkosh, Wis., have been suffering from the heavy current of the Citizens' Traction company jumping to the telephone wires and melting them. They have burned through and fallen on other wires and iron poles, etc., charging them with a heavy current. A horse was knocked down in one instance and a man at the telephone received a severe shock in another.

The Iowa Telephone company finds there is so much service on its Davenport, Ia., board that it will reduce the instruments attended to by each operator from 100 to 66. This will increase the day force from eight to 12 operators.

The Wisconsin Telephone company recently requested permission of the council at Madison, Wis., to place its wires underground. The ordinance prepared to meet that request is unsatisfactory and the company may not accept it. It provides that the conduits shall be large enough to accommodate other wires, which shall be allowed therein on the payment of a reasonable charge. The company complains that electric wires would impair the telephone service if placed in the same conduit, and also that it is unjust to require the company to lay conduits large enough to carry other wires and cables.

The American Telephone and Telegraph company expects to have long-distance connection completed between Superior, Wis., and Minneapolis early this month.

A new switchboard of 100 drops has been received for the telephone exchange at Edgerton, Wis. A farmers' telephone company has been organized near Edgerton, in the town of Christiana, and proposes to build a line from Cambridge to Utica.

The Badger State Long-distance Telephone company has completed its wires to Oregon, Wis., where it will connect with the Dane County Telephone company's system.

The Assembly in St. Paul temporarily shelved a request from the Mississippi Valley Telephone company for permission to tear up a certain street to lay conduits. The reason was that the company was alleged to have torn up the street without permission and it was proposed to teach the lesson of getting permission before proceeding.

The boxes and wires of the late Wisconsin Valley Telephone company, which remained the property of L. S. Tainter of Menomonie, Wis., when the system was sold to the Wisconsin Telephone company, have been sold to Hudson, Wis., men, who will put in a system there.

Long-distance telephone connection has been made with Thief River Falls, Minn., from Red Lake Falls, Minn.

M. A. O'Hair of Delavan, Minn., and P. O. O'Hair of Waverly, Minn., stockholders of the Minnesota Central Telephone company, contemplate a suit to determine the legality of the sale of the line from Willmar, Minn., to Minneapolis, to the Northwestern Telephone Exchange company. They claim that there was no notice to them as stockholders that a sale was under consideration, but that it was made on the quiet a year ago, though still kept quiet, and during the past year they considered themselves as stockholders, having an interest in the Minneapolis-Willmar line. The announcement of the change of ownership has only been made within a short time. These gentlemen and others think they have been mistreated. The attorney for the Minnesota Central company claims that due notice was given and the sale was a necessity, as the Northwestern threatened to parallel its line if it was not sold.

Judge Elwood of Sac City, Ia., has ordered materials to install a telephone exchange at that city.

The Iowa Telephone company has reduced rates at Davenport, Ia., on long-distance instruments $6 a year.

The Central Telephone company of Rockwell City, Ia., will vote on increasing its capital stock to $25,000.

The Home Telephone company of Oskaloosa, Ia., will make improvements to its system to cost $3,000.

The Winona (Minn.) Telephone company has secured new quarters for its exchange and will establish itself therein in October.

Whitehall, Mont., expects toll-line connection with other towns of the state soon.

The Automatic Telephone Exchange company of Seattle, Wash., has been granted a franchise and will proceed with work at once.

The Fonda (Ia.) Telephone company will establish an exchange at Newell, Ia.

Improvements are to be made to the telephone exchange at Estherville, Ia., under the new management.

The Oakville (Ia.) Telephone company will build a line to Wapello, Ia.

The Red Lodge and Wyoming Telephone company will proceed at once with work on its line from Red Lodge, Mont., to Basin City, Wyo. Work will be pushed as far as possible this fall and completed in the spring. The Bridger-Wyoming Telephone company of Bridger, Mont., wants to connect with the former's lines at Chance.

Telephone Conveniences in Hawaii.

Honolulu ranks with Stockholm for extensive use of the telephone. Rates are moderate in Hawaii, and on the island of Oahu, on which Honolulu is situated, there is a telephone to every 41 inhabitants. In Chicago there is one telephone to every 120 inhabitants. The prominent part given to the telephone is noticed by every traveler from other parts of the United States. "The wires run everywhere, even far out into the suburbs," writes Miss Ham to the Chattanooga News. "They do not disfigure the view as in American cities, but seem a part of the vines and creepers that leap from wall to tree, from tree to tree, and tree to house. Nearly every house and store is connected and the rates are so small that they would make a Bell stockholder weep with sorrow and disgust. Most notable of all, the company owns small submarine cables and for a mere pittance will connect a man-of-war or a merchant ship anchored far out in the harbor with the city. Naval and maritime folk are socially important, and this ingenious innovation has proved an invaluable boon to the salons ashore and the ships afloat. On one occasion a friend arranged a dinner party of 12 persons, including the invitation to two naval officers on their ship, invitations to the other guests, ordering supplies and engaging waiters, in half an hour, without leaving the hall in which her telephone was situated. I do not know of any other city in the world where such a thing could be done."

Russian Telephone Extensions.

Between St. Petersburg and Moscow, a distance of 412 miles, is a lately completed telephone line, said to be the longest in Europe. It was established by the Postal-telegraph Department of the Russian government and cost about $200,000. St. Petersburg was first connected by telephone with the imperial summer residences of Gatchino in 1882, with Peterhoff in 1883 and with Tsarskoe Selo in 1885, these lines having also been established by the Department of Posts and Telegraphs. Then followed the connection (completed by private enterprise) of Moscow by telephone with the neighboring places of Bogorodsk, Pushkin, Odintsovo, Kolomna, Podolsk and Serpukher. Later (between 1893-1895) Odessa was connected with Nikolaieff (87 miles) and Rostoff-on-Don with Taganrog (53 miles). In the grand duchy of Finland the telephone system is well developed, nearly all the towns being interconnected. In St. Petersburg, where a private company has hitherto had a monopoly for its introduction and working, its employment is chiefly confined to public and government institutions and persons of high official, mercantile and financial standing. This company's concession will shortly terminate, and the government will then take over the lines, and it promises a general reduction of rates.

Telephone Lines a Servitude on the Streets.

It is the imposition of a new and additional servitude on streets and alleys of a city or town, the Court of Appeals of Kentucky holds, to erect telephone poles and string wires thereon. It also says, in the case of the East Tennessee Telephone company against the city of Russellville, that previous to the adoption of the present constitution, the council of a municipal corporation, without legislative authority, could not grant to any person or corporation the right to use the streets and alleys of a city or town for any purpose other than for which they were dedicated. And it holds that now, when a telephone company takes possession of the streets and alleys of a city or town without the consent of the legislative bodies or boards of the city or town, it has no more right to occupy the streets and alleys than any wrongdoer has who takes possession of the land of another without his consent.

COMMUNICATION.

Privacy of Telephone Communications.

To the Editor of the Western Electrician:

Referring to an article upon the "Privacy of Telephone Communications," by P. H. Clausen, page 188 of the Western Electrician of September 30, 1899, I beg to call your attention to United States patent No. 251,292, granted to James H. Rogers, on December 20, 1881, which is directed broadly to the art of secret telephony upon the principle of divided circuits. The invention disclosed in said patent is now public property, the patent having expired in December last. C. J. KINTNER.

New York, October 2, 1899.

Brodhead, Wis., has joined the new movement and will soon have an Independent telephone exchange, the switchboard and office equipment for which will be of the Sterling Electric company's "Bell-type" manufacture.

Toll-line Extension in the South.

Connections have been established between the Alabama, Mississippi and Tennessee Telephone company (which connects Middleton, Tenn., with Tocopola, Miss., via Pontotoc, Miss.) and the following-named telephone lines: Okolona and Pontotoc; Tupelo and Okolona; Tupelo, Fulton and Amory; Amory and Fayette Court House; Amory and Aberdeen; Okolona and Aberdeen; Aberdeen and Columbus; Aberdeen, West Point and Starkville; Okolona, Houston and Pittsboro; Pittsboro, Sarepta and Water Valley; Houston, and several other telephone lines. This makes a very complete network of Independent telephone lines.

The lines named connect Independent exchanges at Okoloua, Aberdeen, Amory, Columbus, West Point, Starkville and Water Valley.

Other connections will soon be made which will also place in this group the exchanges at Oxford and Holly Springs, Miss., and Bolivar, Tenn.

The Southern Independent Telephone association is doing a good work in Northern Mississippi. The Independent telephone companies are improving their lines and service and bid fair to do a good business. Considerable capital is being invested in telephones, and the people are learning to appreciate their convenience.

GENERAL TELEPHONE NEWS.

The American Bell Telephone company has declared the regular quarterly dividend of three per cent., payable October 16th, to stock of record September 30th.

The Bell Telephone company is said to have secured a lease on all the property of the Wayne County (Ill.) Telephone company. This includes 225 miles of line in Wayne and adjoining counties.

A trust deed has been filed in the county recorder's office at Waterloo, Ia., from the Cedar Valley Telephone company to Ralph Van Vechten, purchaser of $24,000 worth of the company's bonds. The bonds are 48 in number, being for $500 each. They draw interest at the rate of eight per cent. per annum, from September 1, 1899. The purchaser is protected by a blanket mortgage on the company's property.

The Supreme Court of Nebraska has dismissed the complaint and petition of the Nebraska Telephone company, which sought to restrain the state board of transportation from ordering a reduction in rates. The Legislature of 1897 gave the board of transportation control over express, telephone and telegraph companies, and John P. Yieser of Omaha, through the state board, began proceedings looking to a radical reduction in telephone rates. The company secured an injunction in the District Court of the county, but on the hearing Judge Cornish dissolved the injunction. An appeal was taken and the Supreme Court sustained the lower court.

The Board of Education of Detroit received bids from two telephone companies for furnishing 12 telephones for the schools. The Bell company bid $18 a year flat, while the Detroit company, which formerly bid $25, came in with a bid of $25 a year, with a discount of $7 a year. On a vote the contract was awarded to the Detroit company. Then the committee members changed their minds, rescinded their action and recommended that the contract be split evenly, six telephones to each company.

During the week of the Dewey celebration in New York, when it was difficult to get about town, the telephone lines were in great demand. More telephone messages were sent than ever before in one week, and on Thursday, September 28th, the increase was generally 50 per cent. greater than on any one previous day. The telephone people say that the Broad street exchange handled on Thursday 61 per cent. more business than on any previous day, and explained it by saying that bankers, brokers, lawyers, customers, visitors and others determined to crowd all the business necessary for three days into one. In the Cortlandt street exchange the increase was put at 50 per cent. Every available operator was kept on duty and frequent reliefs were made because of the strain.

MANUFACTURERS AND DEALERS.

The Abatis Electric Manufacturing company of Chicago has changed its name and is now the Acme Telephone and Electric company.

The Kusel Telephone and Electric Manufacturing company of St. Louis has about completed the exchange at Warren, Ark., of 300 subscribers, and also one at Tipton, Mo., of 150 subscribers.

The Ericsson Telephone company of New York city has issued a little sheet called the Ericsson Series, which it intends to publish at regular intervals. It is of convenient form for reference and is intended to contain a series of letters giving information of general interest to the public. The Ericsson company handles the well-known Ericsson Swedish telephones, manufactured in Stockholm, Sweden, as well as switchboards and telephone supplies.

Western Electric Encased Motors.

The earliest commercial form of electric motors was the open bipolar type. This form is still in use, but, owing to the increased applications to which motors are put and the variety of circumstances under which they operate, new styles of motors have been developed, and among them the semi-encased and the encased types. Motors are now made both bipolar and multipolar, of open, semi-encased and encased varieties. Fig. 1 shows the latest development of the encased-type machine as manufactured by the Western Electric company. This machine is particularly adapted for use in places where dirt and dust accumulate. Owing to its peculiar construction, it may be suspended from the ceiling, or attached to a wall or post. In Fig. 2 is pictured one of these machines mounted upon a post and driving a special screw press by means of gears.

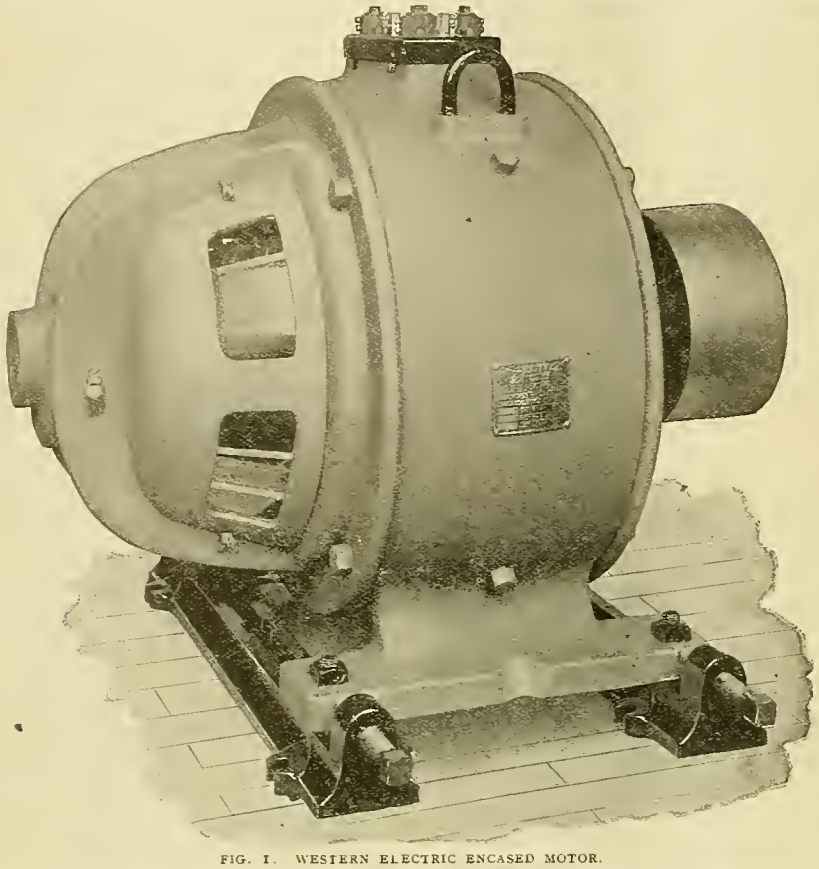


FIG. 1. WESTERN ELECTRIC ENCASED MOTOR.

Two great recommendations—cleanliness and economy—have given the impetus to the motor business. Motors to-day are made to meet any conditions which may exist. There are slow-speed motors, high-speed motors and motors of various intermediate speeds. Machines may be direct-connected, belted or geared to motors, and all that

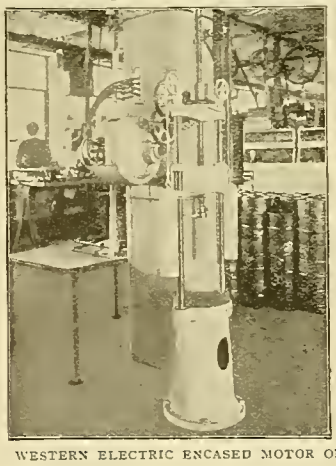


FIG. 2. WESTERN ELECTRIC ENCASED MOTOR ON POST.

a purchaser need to do is to state explicitly the conditions under which his machinery must operate, and the manufacturer of electric motors endeavors to meet the conditions with the most appropriate apparatus within the limit of the cost desired. To show what may be done in the matter of winding machines for certain purposes an interesting article has been incorporated in the new Western Electric catalogue on "Power Motors," entitled "Types of Field Winding and Purposes for Which They are Adapted." This is followed by another short article upon methods for controlling speeds.

The Western Electric company manufactures a large number of motors and generators. Its encased-type machines are made for slow speed and intermediate speed. The semi-encased and open-type machines are made for slow speed, intermediate and moderate speeds. The semi-encased and encased machines are adapted for a back-geared or speed-reducing device, whereby the motors may be coupled direct to the line shaft or individual machines. The encased machines are also adapted for marine purposes as generators, being direct-connected to small engines.

Sturtevant Exhaust Head.

As indicated by the illustration, this exhaust head, built by the B. F. Sturtevant company, Boston, Mass., is designed to separate steam and water by the utilization of centrifugal force. The head is attached directly to the end of the exhaust pipe, from which the steam passes up to the branch pipes and is discharged tangentially within the case. It is thus given a vigorous whirling motion, and the entrained water and oil are thrown outward with great force, striking the cool sides and trick-

STURTEVANT EXHAUST HEAD.

ling down to the outlet at the bottom. The steam, now perfectly dry, finds ready escape through the central opening above. As water weighs nearly 1,600 times as much as exhaust steam, and as centrifugal force is proportional to the weights of the bodies in motion, it is evident that the force acting upon the water is nearly 1,600 times that exerted upon the steam, and that the action is both positive and absolute. These heads are built in sizes to fit pipes from one inch to 20 inches, all sizes above 10 inches being flanged. The case and pipes are of heavy galvanized iron, 16 to 20 gauge, according to size. All external joints are riveted and soldered and the internal pipes are double-braced.

The Frederick, Thurmont and Northern Railway company, Colonel L. Victor Baughman, president, has been granted a franchise to lay its tracks on certain streets of Frederick, Md. The road will run from Frederick to Gettysburg, Pa., via Thurmont and Emmitsburg, a distance of about 31 miles.

Self-propelled Lifeboat.

The first motor-propelled lifeboat tried by the United States has been undergoing experiments at the Marquette life-saving station. A 34-foot boat, the largest in the regular service, was taken for the purpose. At each end were large water-tight compartments, and on and under the decks were similar compartments which brought the boat right side up when overturned. In the rear-end space a 12 horse power three-cylnder engine was set up and the forward compartment was fitted with a tank for holding 75 gallons of gasoline. A pipe ran to the engine and an electric battery made sparks which ignited the gasoline on entering the cylinders. By suitable gearing the engine was made to run twin screws, which are needed to facilitate the boat's turning about.

In speed the boat went seven miles an hour. The engines were stopped, reversed and started backward at full speed in the space of 20 seconds, and in a circle of 50 feet in diameter the boat turned around in one minute and 15 seconds.

When it came to a turn-over test the boat was run between two docks, hooked to a derrick and raised up and tipped over. She was then lowered into the water, and immediately on passing the center flopped over as readily as when the engine was out. In fact, the placing of the engine in her had no effect on her equilibrium, and it is maintained by the builders of the engine that it will run upside down. This, however, was not tried.

The test is the only successful one made in any country. German inventors have made a steam engine that will propel the boat, but it is very bulky, and when a vessel is wrecked time is lost in getting steam up. With the gasoline engine and electric ignition the power is put in immediate use by turning on the gasoline and connecting the electric current.

The assistance to the life savers will be great. Often these men have to row out miles in the teeth of a gale and are exhausted when reaching the vessel, but with the engine to drive their boat, all their strength is saved for the task of rescuing the imperiled lives of passengers and crew.

If adopted, the lifeboat will use the gasoline engine and carry oars and sails for emergencies. It is said that sufficient oil can be stored in the tank for a run of 280 miles.

Reliance Electric Mining Lamp.

The problems involved in the construction of a practical "safety" lamp for miners are many and difficult, from the electrical engineer's point of view. For instance, an electric bulb of such low candle power as can be produced with the current available in a suitable battery has its light concentrated in a very small surface of incandescent filament, and unless this light, concentrated to a small spot, is diffused in some way, there is a deficiency of illumination in a practical sense that is very discouraging. Then, too, the exposure of so bright a spot of light to the eye of the miner in the absolute darkness of the mine is distressing. Therefore, while a diffusion of illumination is to some degree necessary, it must be gained without strain of this kind to the eye. Yet the strongly absorptive power of the black working face of the "drift" calls for a strong illumination. Such circumstances involve the consideration of an adequate reflecting device.

Again, the manipulation of the lamp must involve no skill of any kind. Mistakes must be made impossible. Yet reliability is another important factor. This implies strength of parts and a capability of withstanding roughness of handling. The former is limited by weight and the latter should provide for the certainty of some damage by blows and dirt to the outer casing. The lamp should also be constructed to give light for a definite period, that can be calculated upon with certainty, without diminution of illuminating power. This period should cover the time the miner or "ganger" is below ground, and, to meet all lengths of "shifts" and contingencies, it should be about 12 hours with a moderate surplus.

The battery cells constructed to make delivery of a current sufficient to produce this light will necessarily have to be much more compact and lighter than cells of such capacity usually are. All primary batteries, in which renewal of current delivery means renewal of chemical solutions and a soluble electrode of zinc, are not, it is contended, suited to the hands of the practical miner. But a storage battery can be recharged by connection with a source of electric current, and as, nowadays, nearly every mine has some electrical machinery, or, at least, plenty of surplus power available to drive a small dynamo-machine, this method seems practicable. But the battery must be dry—not relatively, but strictly non-fluid. This last problem is probably the greatest and most difficult.

Finally, economy in use is to be considered. The cost of running must not exceed that of a Davy safety lamp.

The following is a description of a portable electric mining lamp in which these points appear to have been well considered and met.

The general appearance of this lamp is illustrated by Fig. 1, which shows the stout wooden containing case provided with a protective wire netting or grating over the lantern front. The object of this wooden case is to prevent the lamp case proper receiving injury from blows and dirt, and to provide

a protection that in case of injury can be cheaply and easily renewed or repaired. The lamp case proper is shown in Fig. 2, and it consists of a substantial shell of metal, nickeled throughout, having a lid for admitting the insertion of the battery cells, which lid is fastened with a catch. The lamp case is provided with a reflector. At the interior base of the reflector is a screw-socket for the insertion of the incandescent bulb; and the reflector carries a glass front, which, set in a suitable frame, can be opened when a change of incandescent bulb is required. This reflector is constructed on true parabolic lines, but the focal length is very considerable for a reflector of the size, thus allowing of a certain dispersion of the light rays, yet maintaining a certain concentration. In this way a general illumination is attained, as well as a powerful direct illumination. The lamp shell is lined with insulating material, pierced where the central stem of the lamp bulb penetrates the case, as shown in Fig. 3. By moving this switch laterally, the battery is put into or out of circuit and the lamp is lighted or extinguished. A hole in the wooden case, corresponding to the position of the switch, allows of lighting or extinguishing the lamp when encased.

The battery cells—two in number—are shown in Fig. 4. Contact, each with the other, is made by simple juxtaposition. It is claimed that the large surfaces in contact make the connection perfectly reliable. These cells are simply slid into the lamp case, the lid closed, the switch turned into its central position, and the lamp is lighted. For recharging, the cells are merely placed in juxtaposition, are shown in Fig. 4; and suitable connection is made at the free ends or plates with a source of current. This is accomplished by a recharging device provided for the purpose.

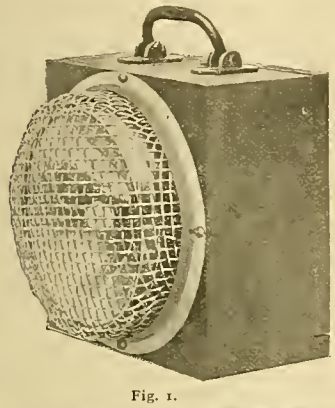


Fig. 1.

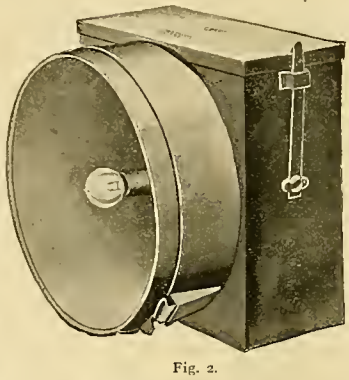


Fig. 2.

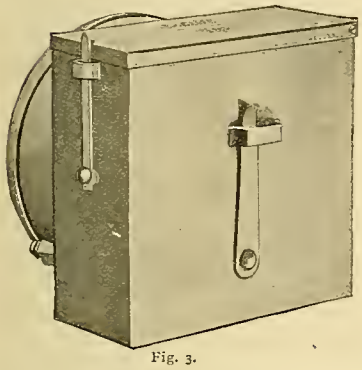


Fig. 3.

Fig. 4.

RELIANCE ELECTRIC MINING LAMP.

These battery cells are of novel design and consist of two specially prepared dished plates, which form the two ends of each cell and the positive and negative electrodes of each cell, separated by a frame of insulating compound, thus constituting the complete cell. The electrolyte is contained or held in a special absorbent of granulated "kieselguhr," and the cell is rendered non-liquid, so that it may be placed and operated in any position.

Each cell is said to have a capacity of seven ampere-hours, or 13 to 14 watt-hours, at a discharge rate of half an ampere. With an incandescent bulb taking half an ampere at four volts, the light is maintained for at least 12 hours, it is said.

The cost of recharging is that of 32 watt-hours. At five cents per kilowatt-hour, the cost of 12 hours is thus one-fifth of a cent—a cost considerably less than that of oil, and involving none of the difficulties and disadvantages of the latter.

As there are no inductive resistances, and, owing to the small electromotive force, there is no possibility of spark formation, consequently, the lamps are put forth as absolute safety lamps.

This lamp is manufactured by the Reliance Lamp Electric company of 131 Liberty street, New York city. It is the design of Dr. Leonard Paget, the well-known electrical and civil engineer, who was associated with M. Gaston Planté in storage-battery work for several years.

The street-railway company of Eau Claire, Wis., will build a steam-power plant on the Chippewa River to operate the interurban line.

Scheeffer Alternating Watt-hour Meter.

After long experience in the manufacture of alternating-current meters the Diamond Meter company of Peoria has introduced its new type of meter. Mr. Scheeffer of that company claims to be the first person who put on the market in the United States a watt-hour meter of the inductive type. The faults of this earlier meter, which have been eliminated in the new type, are: First, the meter was not dust-proof; second, heavy moving parts, which prevented sensitiveness by the large amount of friction, due to the weight of shaft and parts; third, the "permanent magnets" were not permanent, losing their magnetism. These faults resulted in a want of permanence in the meter. Electrical faults were large shunt loss, large loss in the series coils, with consequent large drop in the service and inaccuracy on inductive loads, large effect in change of frequency, and perhaps minor faults.

In the present type "D" Mr. Scheeffer has adopted the round form, and in order to avoid unnecessary weight the cases are made of sheet metal. The projecting flange of the meter is made slightly tapering. On this is placed a rubber band over which the case slips. By gently forcing the case over the taper a perfectly tight joint results. The connecting or binding posts of the meter are covered with a fiber bushing and forced into the meter through holes in the castings, making a tight fit, as the ends of the binding post are not drilled through, being left closed. When the case is on, the meter is hermetically sealed and is dust-moisture and rust-proof.

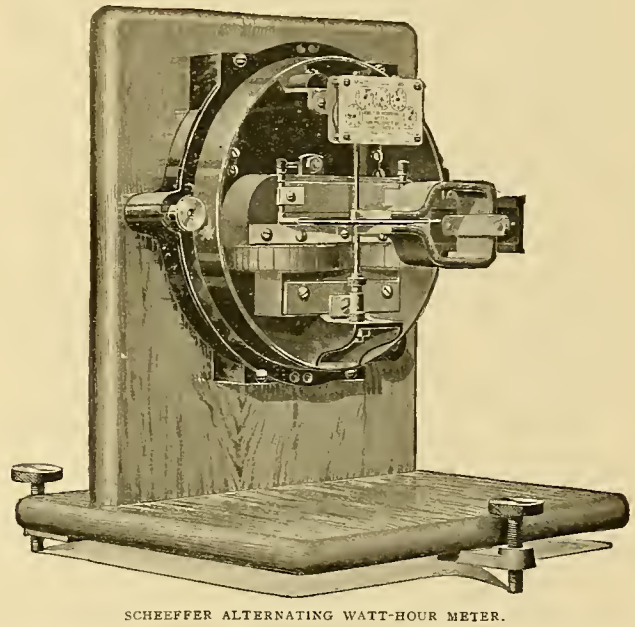
The moving parts consist of a very thin and light aluminum disk, with a light shaft, the whole being very stiff. The damping disk used in the older form is dispensed with. This is an important improvement, as the lightness of the one disk prevents any wear or injury to the jewel and also results in a much better response to sudden changes of load, to which the parts respond very quickly. The damping is as well done with the light disk, without the injurious results of a larger disk.

As the manufacturing of permanent magnets is now much better understood than formerly, it has resulted in the production of magnets which are said to be really permanent. These magnets are perfectly aged, it is asserted, and will remain for years without change. The shunt core of the magnetic system is practically closed, thus avoiding the scattering of any lines of force. This has resulted in the highest economy in the use of a shunt current, the loss being one-half watt on 125 cycles and three-fourths watt on 60 cycles. This result, the company believes, is the closest obtained in a meter.

The series coils consist of only a few turns of wire without any iron core, and therefore there is no inductive drop and very small loss, the drop through the meter being only about one-tenth volt. The meter may be overloaded 50 per cent. without any change in accuracy, it is said.

The meter is so constructed that all parts are readily accessible and simple. A fault of some measuring instruments is their inaccessibility. It is often necessary to make some slight adjustment, and want of accessibility necessitates the sending of the instrument to the factory, causing great delay, inconvenience and some expense, whereas, if the mechanism were easily accessible, the trouble could be corrected in a few moments.

The meter is furnished with a compensator for ready and quick adjustment for very light load. Two knurled posts carry small shields which embrace part of the disk. This causes a slight torque to be given to the disk. One gives a torque toward the left and the other toward the right, and one or the other may be made to predominate. By this means an adjustment is made so that the disk is on a balance and will move with the slightest load, giving a high degree of sensitiveness. If the meter should get sluggish or a want of sensitiveness should manifest itself, all that is necessary is to strike a balance with the compensator. If the jewels should become slightly roughened, it will, as a rule, have no effect on the accuracy of the meter at full or moderate load, but only on a very light load. This can be quickly corrected with the compensator by striking a balance, or new jewels can be replaced in a few seconds without disturbing the rest of the meter or its calibration.



SCHEEFFER ALTERNATING WATT-HOUR METER.

American Institute of Electrical Engineers.

The first regular Institute meeting of the season was held in New York on September 27th, President Kennelly in the chair. The paper of the evening, by Professor William Lispenard Robb of Hartford, Conn., was on "Series Arc Lighting From Constant-current Transformers," and a working model of the apparatus was shown. The discussion was participated in by Messrs. Fleming, Hallberg, Steinmetz and Mailloux.

At the meeting of the council in the afternoon the following-named associate members were elected: Henry Arthur Campbell, Kingston, Jamaica; Leslie Foster Davis, Kingston, Jamaica.

The following-named associate members were transferred to membership: William Enoch Moore, Augusta, Ga.; Henry M. Hobart, London, England; G. Sacco Albanese, Nice, France.

In order to satisfy the increasing demand for the final report of the committee on standardization, the secretary was authorized to publish a special edition, which will be sold at a nominal price. All members of the Institute have already been supplied with copies in the regular edition of the Transactions.

Abundance of Mica in Ontario.

Mr. M. H. Twitchell, the United States consul at Kingston, Ont., reports that there is great activity in the mica mining of that part of Canada. A large section of the country between Kingston and Ottawa is rich in mineral wealth—gold, iron and mica. The mica mines are the only ones which at present seem to be paying, and there is a fair degree of certainty that they will continue profitable. The products of the various mines are concentrated at Ottawa and shipped to the United States; consequently, the quantity and value are unknown to the consul at Kingston. Now, Mr. Twitchell believes that there is an abundance of mica of all qualities, from superior white to the lowest grades of colored mica. From those who are in positions which entitle their opinions to respect, it is learned that there are as many as 100 mica-mining prospects in the vicinity of Kingston. Almost every farmer in the back townships has a mining prospect of iron, gold, copper or mica on his farm.

There is agitation at Sherburn, Minn., for an electric-light system.

CORRESPONDENCE.

New York Notes.

New York, September 30.—Admiral Dewey and the Olympia are the centers of attraction this week. The electrical features of the decorations throughout the city and along the river and line of march are very extensive and beautiful, while the immense design on Brooklyn Bridge, containing the words "Welcome Dewey," formed of over 6,000 16 candle power incandescent lamps, has been a grand success and was plainly visible to Dewey on the Olympia, seven miles away, at Tompkinsville,. But everyone will read in the daily papers throughout the country all about the Dewey days, so your correspondent will not now attempt a further description.

It is reported that the Westinghouse company intends to move its arc-light plant to Newark, N. J., where it already owns the land needed.

Whether relations exist between Tammany Hall and the telephone monopoly in this city, and, if so, what they are, will constitute one of the lines of inquiry by the Mazet committee in the near future. Frank Moss, counsel for the committee, intimated recently that he would follow up the testimony on the subject given by Silas B. Dutcher at the close of last week's hearing. Mr. Dutcher is vice-president of the People's Telephone company, of which Darwin R. James is president. This company was organized to fight the monopoly and has made contracts with 7,000 subscribers, agreeing to give them telephone service for $100 a year. It is stated that the company intends to begin business as soon as it obtains a permit from Commissioner Keating of the Department of Highways to open the streets.

At a meeting of the stockholders of the Erie Canal Electric Traction company, held last Tuesday, the following-named directors were elected: Louis A. Von Hoffmann and William Mertens, both of the banking house of L. Von Hoffmann & Co.; Henry R. Ickelheimer, of the banking house of Heidelbach, Ickelheimer & Co.; John G. Carlisle, ex-secretary of the treasury; Charleton T. Lewis of the Mutual Life Insurance company; Thomas C. Platt, president of the United States Express company; Frank W. Hawley, president of the West Indies Telegraph and Cable company; James Virdin of the Corporation Trust company; William H. Baker, vice-president of the Postal Telegraph and Cable company, and George W. Balch of the Produce Exchange. The officers of the company elected were: Louis A. Von Hoffmann, president; Frank W. Hawley, vice-president, and A. B. Donaldson, secretary. This company was organized recently to introduce electricity as a motive power, not only upon the Erie Canal, but upon all the canals in the United States and upon the canals of France and Holland. It possesses patents applying electricity to a motor or tractor which, from the towpath, so it is said, will propel or tow six ordinary canal boats of 240 tons each five miles an hour. The capital of the company, amounting to $5,000,000, has been underwritten by a Wall street syndicate.

The educational department of the Harlem branch Young Men's Christian Association, at No. 5 West One-hundred-and-twenty-fifth street, has added to its curriculum a course in electricity. The aim is to make this course of practical value to all men who are interested in any branch of electrical work. The school will be in charge of Mr. William J. Clarke, who has seen active service in nearly every branch of electrical work. The sessions will be held on Tuesday and Friday evenings, commencing October 17th, and the course will consist of 48 lectures. Each lecture will be illustrated by diagrams thrown upon the screen by means of a powerful stereopticon, so that each member of the class may readily follow the explanations of the teacher, and in addition to this a large amount of apparatus will be used in illustrating the work.

Electric cars are now running successfully on the One-hundred-and-twenty-fifth street cross-town line of the Third Avenue Railroad company. The conduit system is used where formerly the cars were operated by cable. M. L. G.

Canadian Intelligence.

Ottawa, September 29.—The deal for the transfer of the Hamilton and Dundas electric railway to the Cataract Power company was closed on the 17th inst. The company paid $110,000 cash, besides assuming bonds of $90,000.

The Royal Electric company of Montreal has notified consumers of electric light in that city and its suburbs of a reduction in the lighting rates of one-fourth cent per ampere-hour, to take effect on October 1st. The present lighting rate is three-fourths cent per ampere-hour.

A company is being organized among the American visitors at Murray Bay to establish an electric plant for the purpose of supplying Murray Bay, Pointe a Pic and Cap a l'Aigle with electric light.

Few business concerns in Canada can show such rapid progress as the Toronto Electric Street Railway company. Each year sees a substantial increase in its receipts, and, in consequence, in the city's share, also, of the profits. A table, compiled by the city treasurer, shows an increase of $148,210 in the gross returns of this year over those of 1897-98, and an increase of $14,821 in the percentage which comes to the city.

Professor Graham Bell, inventor of the telephone, spent the summer at his beautiful home at Beddeck, Cape Breton. It is understood that this year he is devoting nearly the whole of his time to experiments with flying machines, and is confident that he is not only on the right track, but within measurable distance of success. He is developing the kite idea, experimenting with planes of various sizes and weights. He has discarded the generally accepted principle that the machine must be of extraordinary lightness, and is calculating on securing stability and steadiness from weight.

The annual meeting of the Canadian Fire Underwriters' association, which met at Quebec this year, closed its sessions a few days ago. The underwriters consider the inspection of electrical installations of the greatest importance. Two fire cases occurred in Montreal recently where the origin of the fire could be traced to the electric wires in each of the buildings burned. The underwriters hope that this question will be taken up by the city councils of leading cities. The Canadian association, after consultation with electricians, has framed a set of rules, but, of course, can only enforce them against the insurers.

It is expected that the extension of the telegraph system of the Gulf of St. Lawrence to the Straits of Belle Isle will shortly be effected. At present the line of the north shore of the gulf extends from Murray Bay to Big Romaine, a distance of 500 miles. The stretch between Big Romaine and Chateau Bay, on the Belle Isle Straits, is 315 miles, and the contract for the construction of the telegraph line between these points has been let to Mr. Xavier Gendreau of Quebec. Chateau Bay is the nearest point on the Labrador coast to Belle Isle, the light station at the "front door" of the St. Lawrence, which station it is intended to connect with the government signal service. But the experts are as yet undecided how the connection shall be made. Of course, a cable could easily be laid from Chateau Bay to Belle Isle, but the grinding of the immense masses of ice which pass through the straits in spring would make short work of a cable. The only alternative, therefore, seems to be the adoption of a scheme of wireless telegraphy, and the experts of the Public Works Department of Canada are eagerly following the results of experiments now being made in Europe, with a view to adopting wireless telegraphy as a means of connecting Belle Isle with the coast signal system. A. V. W.

Niagara Falls.

Niagara Falls, N. Y., September 29.—North Tonawanda and Lockport are to profit more largely by the Niagara power development, as the Niagara Falls Power company will soon commence the construction of a new power-transmission pole line from Niagara Falls to North Tonawanda, and later on will extend it to Lockport. Next summer this new line will also be extended to Buffalo. When the new transmission line is completed, the present line will be used exclusively for the Buffalo service. The new line to North Tonawanda will run alongside the present line, the poles standing nearly 30 feet distant from the present poles. It will be recalled that the Niagara Falls Power company owns a right-of-way about 30 feet wide, from its lands at Niagara Falls to Buffalo. Lockport is also 25 miles from the Falls by the North Tonawanda route.

The application of the International Traction company to be permitted to lay tracks along the street known as the Riverway, a part of the state reservation at Niagara Falls, between the foot of Falls street and Niagara street, has been approved by the commissioners of the state reservation, and it now goes to the Land Office commissioners, this being one of the provisions in the bill which was passed by the last Legislature, making the laying of tracks on the reservation possible. The commissioners of the Land Office will no doubt approve of the application, and then the International Traction company will be allowed to lay a single track through the street referred to, and will pay the state of New York $1,000 annual rental for the privilege. The construction of this short piece of track will form the last link in the belt-line trolley service around the gorge. D.

PERSONAL.

Mr. Henry A. Morss of the Simplex Electrical company of Boston was in Chicago last week.

Ezra F. Scattergood, instructor of mathematics, electricity and physics at Rutgers College, has accepted the chair of physics in the Atlanta School of Technology. He has just returned from a year's study in Europe, where he went on a fellowship from Yale.

ELECTRIC LIGHTING.

The city of Winnipeg has adopted the Western Electric system of arc lighting and has now installed a complete plant for street lighting under municipal control.

An electric-light plant is being installed at Pontotoc, Miss. The officers of the company are: President, O. J. Knox; secretary and treasurer, Jeff Wilson; managers, C. P. De Journett and J. V. Cornelius, all of Pontotoc, Miss. The company expects to be ready to turn on the light by the 15th of October.

The city-lighting service of the City of Mexico comprises 481 electric street lights of 2,000 candle power, 366 of 1,200 candle power and about 150 incandescent lights of 16 and 50 candle power. The cost of the service per month is about $24,000.

The Winchester (Va.) Gas and Electric Light company has been awarded a five-year contract for lighting the city at $35 a lamp per annum. It is said that the company will erect an entirely new plant and will put in an incandescent system for private use.

ELECTRIC RAILWAYS.

It is said that the group of capitalists known as the Whitney-Widener-Elkins syndicate has offered $13,000,000 in cash for the Northwestern elevated railroad now building in Chicago.

The Fort Wayne (Ind.) Consolidated railway, which has been in the hands of a receiver for some time, was sold on September 27th to George A. Garretson of Cleveland, O., for $1,092,000.

The work of installing the new electric railway in the City of Mexico, recently described in the Western Electrician, is rapidly nearing completion, and it is now expected that the first line through the city will be in running order by November 1st.

Judge Kirkpatrick of the United States Circuit Court for the District of New Jersey has issued a perpetual injunction restraining the Rahway (N. J.) Electric Light and Power company from further infringement of the Anderson trolley contact-spring patent, No. 412,155, belonging to the General Electric company.

AUTOMOBILES.

W. H. Chapman of Portland, Me., has designed a very light automobile, built on the bicycle principle. It is said to weigh only 380 pounds. There are two motors, made by the Belknap company of Portland, of one-half horse power each. The storage battery is in front, and the case may be covered and used for a child's seat.

An important electric-vehicle concession is said to have been granted by the municipal government of the City of Mexico to Charles L. Seager of New York, who acts for the Electric Vehicle company, in which are interested Messrs. Whitney, Widener and Elkins, with many tributary companies organized for the large American cities. The concession is for a complete public-coach service of the latest pattern, to run through the principal streets of the city and in the populous suburbs of the capital.

TECHNICAL SCHOOLS.

Prof. Clement D. Child, of the department of chemistry at Colgate University, Hamilton, N. Y., announces a new course in electrolysis,

A pamphlet containing an announcement of the department of electrical engineering has been issued by the University of Illinois. A number of new courses in this department have been added to the curriculum in the fields of electro-metallurgy, alternating-current working and polyphase testing, and electric-lighting and power plants. The equipment of the electrical engineering laboratory is being continuously increased for regular and advanced work in these branches. The four-year undergraduate course has been made elective for the last year and a half; that is, at the middle of his third year a student may elect his further work, as follows: (1) regular elective course; (2) electro-physical course; (3) electro-chemical course. Five years of work must be completed before the degree of electrical engineer is given, the fifth year being devoted entirely to special work. During this last year the principal or primary subjects are elected from the advanced electrical engineering course and the secondary or subordinate subjects are elected from the advanced courses in mathematics, physics, chemistry and mechanical engineering. The pamphlet contains the requirements for the degree of B. S. in electrical engineering and that of E. E., and also gives a general description of the courses offered. William S. Aldrich is the professor of electrical engineering.

On Wednesday, September 27th, the work of the Massachusetts Institute of Technology was resumed. Since the end of the last term some changes have been made in the faculty. Adolph Rambeau, Ph. D., has been made professor of modern languages and has charge of that department. Arthur A. Noyes, Ph. D., formerly associate professor of organic chemistry, has been made professor of theoretical and organic chemistry. Jerome Sondericker, C. E., formerly assistant professor of applied mechanics, has been made associate professor of applied mechanics. Allyne L. Merrill, S. B., formerly assistant professor of mechanism, has been made associate professor of mechanism. Edward F. Miller, S. B., who was assistant professor of steam engineering, has been made associate professor of steam engineering. Carleton A. Read, S. B., who was an instructor in mechanical engineering, has left to take charge of the mechanical engineering department in the New Hampshire College at Durham. George V. Wendell, Ph. D., has returned from three years' study in Germany

and resumes his duties as instructor in physics. Frederic H. Keyes, S. B., and Alexander W. Moseley, S. B., have left to take up professional work. Frederick A. Hannah, S. B., has accepted a position in the mechanical department of the Brooklyn Polytechnic Institute. Captain John Bordman, Jr., who was instructor in military science, is on his way to the Philippines with the Twenty-sixth United States Infantry, of which he is the regimental adjutant. Myron L. Fuller, who was an assistant in geology, has been made an instructor in geology. The following-named men have been made assistants: Henry E. Andrews, A. B., in English; Alvan L. Davis, S. B., and F. L. H. Kimball, S. B., in mining engineering; Miles S. Sherrill, S. B., in analytical chemistry; Etheredge Walker, S. B., in mining engineering; William S. Newell, S. B., in mechanical engineering; George H. Riker, S. B., in mechanical drawing, and Frank R. Swift in mechanical engineering.

PUBLICATIONS.

The B. F. Sturtevant company of Boston, Mass., has just issued a circular relating to its exhaust heads, which makes clear the efficiency of centrifugal force as a means of separating water and steam.

Wood high and low-frequency alternating-current dynamos are described in two bulletins recently issued by the Fort Wayne Electric Works. The manufacturers state that nothing has been spared to make these machines first-class in every respect, and that for simplicity, workmanship and successful operation they leave nothing to be desired.

The Electric Appliance company, Chicago, is mailing, upon application, copies of its Packard transformer catalogue. This pamphlet, beside giving prices, contains articles on "Transformers and Their Profitable Use," by Dugald C. Jackson, C. E., and on general instructions for testing transformers. It is full of valuable data for the transformer user.

Professor Elihu Thomson's interesting lecture on "Electricity at High Pressures," delivered before the New York Electrical society on March 29, 1899, has been published in pamphlet form. Professor Thomson has always taken a particular delight in high-potential experiment and research, and his apparatus formed one of the most instructive and attractive features of the great exhibit of the General Electric company at the World's Fair.

The initial number of the Automobile Magazine of New York is interesting and creditable. The new publication is of the regular magazine form and is to be published monthly. The first issue contains about 100 pages of reading matter and is handsomely illustrated. The articles are of a popular character, and in one "some cold facts about the horse" and his stupidity are laid before the public. The price of the magazine is 25 cents a copy.

A catalogue devoted to the merits and application of granite-rock wool as an insulating material for pipe and boiler coverings has been issued by the American Insulating Material Manufacturing company of St. Louis. This material is said to be produced from pure rock fiber and to contain no cork, sponge, hair or other animal or vegetable matter. It can be subjected to moisture for an indefinite time and is believed to be practically indestructible.

A price-list of electric air heaters has been issued by the American Electrical Heater company of Detroit. Heaters for any voltage up to 250 are listed, and the dimensions, prices and maximum number of watts are given for the different styles quoted. The company does not claim that it is economical to heat residences throughout by electricity, unless the current is produced at a very low cost, but for such purposes as raising the temperature in certain rooms to higher temperatures than the rest of the house, heating small offices, etc., the statement is made that no other system can compare with the electric air heater in efficiency, cleanliness and convenience.

MISCELLANEOUS.

The Globe Electric company of St. Louis, Mo., has been incorporated with a capital stock of $100,000. The stockholders are Gustav Heidel, George A. Clark, Gustav Miller and Samuel W. White.

A recent note from Paris is to the effect that M. Lanessan, the minister of marine, has ordered the construction of four submarine torpedo boats at Rochefort. They are to be named the Farfadet, Corrigan, Lutin and Gnome.

The Ball Electric company of Yonkers, N. Y., has been incorporated with a capital of $300,000. The directors are Abram Sebring and E. M. Roberts of Brooklyn, D. S. Remsen of Dobbs Ferry, W. F. Randall of New York city and C. D. Silleck of Ridgewood, N. J.

Thomas Braniff, Jr., of the City of Mexico has petitioned the Department of Encouragement for permission to establish a new industry in that city for the manufacture of aluminum. He states that the capital employed will not be less than $1,000,000. Electrical energy derived from water power in the state of Vera Cruz will be employed.

Evelyn B. Baldwin, an observer of the United States Weather Bureau, who was connected with the Wellman expedition to the Arctic regions, made valuable meteorological observations during the trip. His most striking and important contention is that the electric energy and force which produce the aurora borealis can be—and one day will be—utilized by science as a power, as coal is used, to perform useful work.

Edward Luessen, a young man of Oshkosh, Wis., was almost instantly killed recently by grasping a live electric-light wire. He was repairing a tin roof and had evidently taken hold of the wire to raise it over his head. The wire, which was poorly insulated, carried a 2,500-volt current from the local electric-light works, and as the roof was of tin, it is evident that the whole charge passed through the man's body.

The lords of the admiralty are so well satisfied with experiments made with the Marconi system of wireless telegraphy on board the Juno, during the recent British naval maneuvers, that they have ordered a complete set of the apparatus to be supplied to the Defiance, torpedo schoolship at Devonport, where a further series of experiments will be carried out under the direction of Commander Nicholson. This officer has made a special study of wireless telegraphy, and was sent to the Juno, as second in command, in order to watch the working of the system of Signor Marconi.

The secretary of the navy has awarded the following contracts for the construction of the power plant and cranes for the New York navy yard: Westinghouse Electric and Manufacturing company of Pittsburg, Pa., plant complete, $175,100; Niles Tool Works, Hamilton, O., one four-motor electric traveling crane, $11,300; Morgan Engineering Works, Alliance, O., one three-motor electric traveling crane, $6,930; Pawling & Harnischfeger, Milwaukee, Wis., two three-motor electric cranes, test load, 13 tons, and two three-motor electric traveling cranes, test load, 15 tons, $17,550.

TRADE NEWS.

A useful metal paper-cutter is a valued souvenir that is distributed to their patrons by W. C Sterling & Son, Monroe, Mich., manufacturers of cedar poles, ties, shingles, etc.

The Knox Auto-motoneer company of Chicago has been incorporated to deal in mechanical and electrical devices, the authorized capital being $5,000. The incorporators are Joseph B. Woodruff, George W. Knox and Mason B. Starring. Mr. Knox is the chief electrician of the Chicago City Railway company and Mr. Starring is counsel for the same company.

Duncan Bond, Denver agent for the Ball Engine company, Erie, Pa., has closed contract with the Mountain Electric company in Denver for two 14 by 14 and one 10 by 12 Ball engines of the new internal self-oiling type. These engines are to be built for direct connection to two 75-kilowatt and one 37½-kilowatt Westinghouse generators, and are to be installed, with the dynamos, by the Mountain Electric company in the Tabor Opera House building in Denver, which is now being remodeled by the present owners, David H. Moffatt, John F. Campion, Messrs. Bennett and Myers and William Byrd Page, all of Denver, and ex-Governor Baxter of Wyoming, under the name of the Bi-metallic Investment company. When completed, this will be one of the largest and most modern isolated electrical plants in Denver.

BUSINESS.

The Western Electric company carries in stock a complete supply of the Nungesser dry chloride of silver and closed-circuit batteries.

The Hancock Inspirator company of Boston announces that its apparatus can now be obtained only from the company and that no other person, firm or company is its agent.

The Ward Leonard Electric company of Bronxville, N. Y., announces that it has produced some new types of rheostats. One of these new instruments is used to reduce to one-half the speed of a motor whose torque is constant at all speeds; for example, a motor driving line shafting. Another of the principal types produced has a two-to-one taper in ampere capacity, and is intended for reducing to one-half the speed of a motor driving a ventilating fan.

The Western Electrical Supply company of St. Louis says that it has demonstrated in a very practical and conclusive manner that an arc-lamp and apparatus department is not only a necessary, but a paying adjunct to an electrical supply house. This company is agent for the Eddy direct-current and the Warren alternating-current apparatus, and reports that it has recently closed a number of very satisfactory deals. Wherever it has installed this apparatus it has been very satisfactory. The company is also agent for the Adams-Bagnall enclosed arc lamps. It reports that this department is crowded with orders, and that in very few instances where it has had these lamps in competitive tests have they failed to come back without the order. The general supply business of the company has been exceedingly good. Its policy of carrying a complete line and ability to make prompt and satisfactory shipments from stock have earned for the firm a very good reputation. A complete and up-to-date line of catalogues, covering everything pertaining to electrical apparatus and supplies of every description, has been recently issued by the company and will be mailed on application.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 26, 1899.

633,558. Electric Railway. Richard W. Barkley, New York, N. Y. Application filed October 23, 1893.

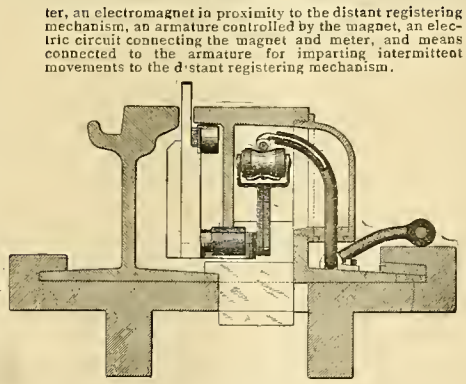
There are combined with a current collector a movable carrier therefor, a spring connected with and moving the carrier in one direction, a stationary incline and connections for moving the carrier against the force of the spring, the connections being operated by the incline, with an air chamber and a conductor insulated by the chamber. (See cut.)

633,565. Device for Lighting Lamps by Electricity. Henry M. Brigham and Svend M. Meyer, New York, N. Y., assignors to the Empire Self-lighting Oil Lamp company. Application filed February 5, 1898.

A device is described which comprises a suitable source of electricity and conductors, a resistance coil adapted to be rendered incandescent by the electric current, a sliding bar mounted on the burner, and on which the coil is mounted, and a contact device with which the coil-carrying bar engages so as to close an electric circuit through the coil in the act of moving the coil into lighting position.

633,567. Meter-registering Device. John M. Byron, Boston, Mass., assignor to the Rogers Liquid Meter company, Boston, Mass., and Portland, Me. Application filed September 7, 1898.

A liquid meter is combined with an oscillating cylinder and oscillating shaft, a registering mechanism operated by the rotation of the shaft, a yielding electrode in position to be contacted by a pin, but insulated from the meter, a registering mechanism located at a distance from the meter, an electromagnet in proximity to the distant registering mechanism, an armature controlled by the magnet, an electric circuit connecting the magnet and meter, and means connected to the armature for imparting intermittent movements to the distant registering mechanism.



NO. 633 558.

633,576. Casing for and Mounting of Electrical Fuses or Cut-outs. Louis W. Downes, Providence, R. I., assignor to the D. & W. Fuse company, Providence, R. I. Application filed January 12, 1899.

The base and cover of a two-part inclosing casing for electrical fuses is combined with insulating blocks, binding posts, contacts and an electrical fuse.

633,577. Casing for and Mounting of Electrical Fuses or Cut-outs. Louis W. Downes, Providence, R. I., assignor to the D. & W. Fuse company, Providence, R. I. Application filed January 28, 1899.

The combination with a plug having a contact at each end, and a fuse connected between the contacts, of a socket having a sleeve contact in its closed end and a spring contact at its open end.

633,586. Printing-telegraph System. Clarence L. Healy, Newark, N. J. Application filed February 17, 1899.

A printing-telegraph transmitter, having combined with the transmitter shaft the clutch wheel thereon, and the clutch for engaging the clutch wheel, a clutch magnet for effecting the positive movement of the clutch and controlled from the keyboard, press relays controlling the press circuits, a time relay for determining the closure of the press relay, and a release magnet for the clutch controlled by the time relay.

633,594. Electric Traction of Railway Trains. Otto H. E. Kaselowsky, Berlin, Germany. Application filed July 1, 1898.

Reference is made to a system of electrical propulsion, having motors on the separate cars of the train, controlling devices one at each end of the train for jointly closing the circuit to the motor whereby both controllers need to be adjusted in order to start the train, and upon the independent operation of either controller the train will be stopped, a power station carried on the train, a common-return conductor and a separate line for each car which passes from the controller at one end of the train to that at the other.

633,597. Sprinkler Car. John B. Kenison, Lynn, Mass., assignor to the American Car Sprinkler company, Worcester, Mass. Application filed November 15, 1898.

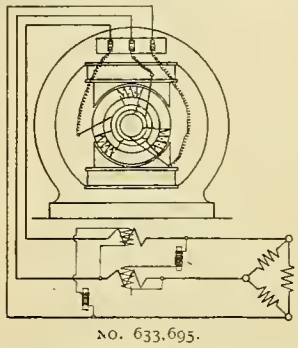
One claim reads: In a sprinkler car the combination of a car body, a tank carried thereby, sprinkler pipes connected to the tank, an electric motor, a rheostat arm, and means controlled by the pressure generated by the pump for shifting the rheostat arm to start and stop the motor.

633,608. Advertising Street Annunciator for Cars. Phillip H. Patriarche, Toronto, Canada. Application filed May 16, 1898.

A magnet and armature operated through the closing of an electric circuit are combined with the rollers of a street annunciator.

633,623. Street-indicating Device for Street Cars. Samuel Squire, Westfield, and Arthur Knowles, New Bedford, Mass. Application filed December 21, 1898.

Features of the device are a source of electricity, two electromagnets, two push buttons and conducting wires connecting the source, magnets and buttons.



NO. 633,695.

633,641. Dynamo-electric Machine. Charles A. Eck, Newark, N. J. Application filed July 28, 1899.

A brush-holder is described which has two superposed compartments extending parallel to each other and a fastening piece extending at an angle to the compartments.

633,675. Weighing and Package-filling Machine. George W. Watson, Boston, Mass., assignor to the Electric Scale company, Kittery, Me. Application filed March 11, 1898.

An electric machine having a double-contact mechanism, consisting of a main contact and a supplemental contact, the main contact being made by the tipping of the scales, the supplemental contact being made by mechanism set in operation by the closing of the main-contact mechanism, which breaks the main contact after the supplemental contact is made, and independent but co-operating mechanism, which breaks the supplemental contact after the main contact is broken.

633,690. Apparatus for Reproducing Motion. Adolf Franke, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed February 23, 1899.

An apparatus combining a transmitter having two sets of multiphase windings for producing oppositely rotating fields in the transmitter, with a receiver having two sets of multiphase windings for producing oppositely rotating fields therein, and electrically associated armatures subjected to the influence of the fields of the transmitter and receiver.

633,695. Motor-meter for Three-phase Currents. Georg Hummel, Munich, Germany. Application filed December 27, 1897.

A three-phase motor device adapted for measuring the energy in three-phase systems, comprising in its structure a combination of rotating means adapted to actuate a register and a plurality of pairs of coils acting inductively upon the rotating means, one coil of each pair being in series or series relation with the work circuit and the other coil of each pair being in shunt or shunt relation with the work circuit, and means for shifting the phase of the currents in the shunts backward 30 degrees with respect to their tensions. (See cut.)

633,702. Electrical Measuring and Indicating Apparatus. Carl F. Rodde, Gross Lichterfelde, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed May 11, 1899.

An electrical measuring instrument is combined with a circuit-controlling device connected with a secondary circuit, a movable needle or part of the measuring instrument adapted to swing into and out of position for engagement with the circuit-controlling device, and an actuated lever or part adapted to move the needle when it is in a predetermined position, whereby the circuit-controlling device is governed and the secondary circuit is in turn controlled.

633,713. Electric-motor Truck. Wilfred E. Boughton, Philadelphia, Pa., assignor to the Lorain Steel company of Ohio. Application filed September 12, 1898.

The combination, in a motor truck, of a pair of side bars supported by the axle boxes, and a pair of motor-sustaining bars detachably connected to depending portions of the side bars, no portion of the side bars or their depending portions being beneath the under side of the motor-sustaining bars when the connections are detached.

633,763. Motor Vehicle. Louis Krieger, Paris, France. Application filed August 1, 1899.

An electric motor mounted on a false or supplementary axle arranged as a prolongation of the wheel axle of a vehicle and connected with the false or supplementary axle by means of a spring, so that the motor is capable of angular movement about the axis which carries it when differences of effort are produced on the gearing, and is protected against shocks or jars.

633,771. Switch for Electric Circuits. Gilbert Wright and Christian Aalborg, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed January 30, 1899.

A double-throw switch is described, which has in combination with a base having middle and end terminals, a double-end laminated contact member, an operating lever, a supporting arm connecting the contact member with the base and with the operating lever, a locking device supported by the arm and operated by the lever, as the laminated contact member reaches either circuit-closing position.

633,772. Automatic Circuit-breaker. Gilbert Wright and Christian Aalborg, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed March 23, 1899.

The circuit-breaker combines with a pair of main stationary contact terminals and a carbon shunt terminal in approximately vertical alignment a pivoted laminated contact member for bridging the main terminals, toggle levers for moving the laminated contact member into operative position, a movable shunt contact piece, and a supporting arm therefor pivoted to the laminated contact member.

633,773. Circuit-breaker. Gilbert Wright, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed March 23, 1899.

An automatic electric circuit-breaker is described having stationary and movable contact terminals, toggle levers for closing the breaker and constituting the sole means for locking the same, and knife-edge bearings for the levers.

633,786. Trolley Stand. Harry W. Brooks, Braddock, Pa. Application filed July 6, 1899.

The stand comprises a base, a casing, standards secured thereto carrying a swiveled sleeve, a socket swiveled in the sleeve, a trolley pole secured in the sleeve, and a spiral spring connecting the socket and the base.

633,801. Means for Utilizing Galvanic Cells or Batteries. Angel de Castro, New York, N. Y., assignor of one-half to Joaquin Ferro, New York. Application filed July 28, 1898.

An electric motor provided with a fly-wheel is combined with a series of cells or groups of cells, a switch for throwing the cells or groups of cells into and out of circuit in quick succession and at frequently recurring periods, a governor and a switch controlled by the governor and serving to cut the cells or groups of cells out of circuit with the motor when the speed reaches a predetermined maximum and to restore them to the circuit when the speed falls to a predetermined minimum, whereby the cells are each given frequent periods of inaction in which to recover, and all are given longer periods of recovery when given speed is attained.

633,826. Electrically Operated Typewriter. William R. Fox and Glenn J. Barrett, Grand Rapids, Mich., assignors to the Fox Machine company, Grand Rapids, Mich. Application filed November 8, 1897.

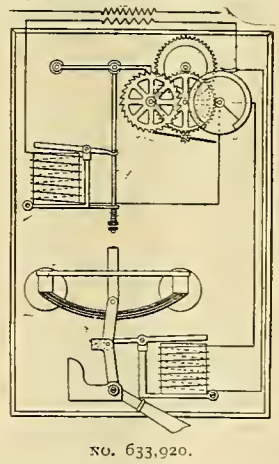
The type, type bars and links, the keys, the plurality of rock-shafts horizontally arranged, one for each key, the pivoted bell-crank levers, a connection between each rock-shaft and one of the bell-crank levers to operate the same to position one of the links on the depression of a key, are combined with an electrically operated device to actuate the positioned links.

633,829. Static Electric Machine. José Gallegos, San José de Guatemala, Guatemala. Application filed June 19, 1899.

A static induction machine, comprising a series of stationary coils and means for connecting them with a supply of static electricity, movable coils arranged to pass adjacent to the stationary coils, and collecting devices for connecting the movable coils with the ground when they register with the stationary coils, and for connecting the movable coils with a consumption apparatus when they are in a position between the stationary coils.

633,855. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed January 30, 1899.

The system comprises a main transformer having an auxiliary secondary winding, a supplemental transformer having its windings respectively in series with the main and auxiliary windings of the main transformer and means for varying the active length of the auxiliary winding.



NO. 633,920.

633,856. Distributed Winding for Electrical Machines. Benjamin G. Lamme and John P. Mallett, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed February 6, 1899.

An electrical machine, combining a slotted core with a continuous multipolar winding having the middle conductor or one of two middle conductors for each one or more phases for each pole connected at its respective ends to the nearest side conductors of the phase or phases corresponding to the adjacent poles.

633,857. Dynamo-electric Generator. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed April 14, 1899.

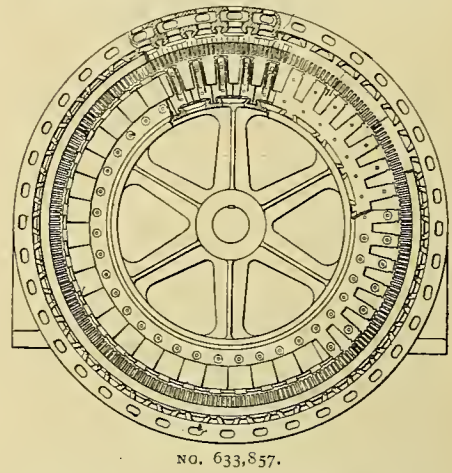
The generator has a rotary, laminated field-magnet core having radial pole pieces provided with coils and with side grooves adjacent to the outer ends of the coils, metal coil-retaining wedges or plates held in position by projections located in the grooves and projecting over the edges or tips of the pole pieces. (See cut.)

633,858. Field-magnet Coil for Electrical Machines. Benjamin G. Lamme, Pittsburg, and Charles E. Skinner, Wilkinsburg, Pa., assignors to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed June 14, 1899

A field-magnet coil, comprising a plurality of concentric divisions of copper strap bent edgewise, the turns of each division being separated by insulation, and the several divisions having bare edges separated by air spaces.

633,887. Electric-railway Rail Bond. Thomas J. McTighe, New York, N. Y. Application filed May 24, 1899.

A rail bond made of wrought metal in one integral piece comprising shouldered solid rail-attaching terminals and an edgewise-yielding flat connecting strap.



NO. 633,857.

633,920. System of Electrical Distribution. Lewis B. Stillwell, Niagara Falls, N. Y. Application filed May 24, 1899.

The system comprises a main supply circuit and a plurality of subordinate distributing circuits, in combination with a circuit-breaker for each circuit and a time-measuring controlling device for each circuit-breaker, each of the devices corresponding to a subordinate circuit being set to insure the opening of its breaker before the breaker of any dominating circuit can be automatically opened. (See cut.)

633,944. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed March 4, 1899.

A mechanism for automatically supplying weft to a loom while the latter is running, comprising means for controlling the operation of a supplying mechanism, consisting of an open electric circuit including a generator and an electromagnet.

633,945. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed March 29, 1899.

An electrically controlled weft-supply mechanism for looms is described.

633,951. Timing Device. William M. Brown, Johnstown, Pa. Application filed September 26, 1898.

Features of the device are an electric source of supply, a locking member, an electromagnet adapted to act upon the same, a switch, connections between the switch, electromagnet and electric supply, an alarm bell, a contact moving with the time movement, a second contact in the line of movement of the moving contact, and connections between the alarm bell, the contacts and the source of electric supply.

633,969. Automatic Electromagnetic Friction Brake. Egbert M. Tingley, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed May 18, 1899.

The combination with a brake and a constantly acting brake-setting means of a plurality of magnet coils energized by polyphase currents, a movable core section or armature for each coil and means for connecting the same to the brake-setting means to oppose the normal action of the means, the coils and armatures being arranged in tandem so as to exert a straight-line pull when energized.

633,971. Car or Train-lighting System for Electric Railways. Ernest R. Hill, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed April 14, 1899.

The system embodies positive, negative and neutral contact conductors, a car or train provided with two current-collecting devices arranged to severally engage one or both of the positive and negative contact conductors, and two sets of lamps severally connected between the respective collecting devices and the neutral conductor.

633,972. Current Collector for Electrical Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed June 5, 1899.

A collector ring for electrical machines comprising a contact ring, a supporting band and intermediate conducting and supporting arms.

633,976. Loom. Malcolm G. Chace, Central Falls, R. I., assignor of seventeen-twentieths to William H. Baker and Frederic E. Kip. Application filed April 7, 1898.

An automatic filling, changing or supplying mechanism is combined with electrically actuated means for controlling the time of its operation.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, OCTOBER 14, 1899. No. 16

Marconi and His Wireless-telegraph System at the International Yacht Races of 1899.

If it is true, in a literal sense, that "distance lends enchantment to the view," then those on board the steamship Ponce on Tuesday of last week will for this and several other reasons record in their diaries "October 3d—Truly a delightful day." To a novice witnessing an international yacht race for the first time, though, there is a sense of disappointment when the realization comes, as it does the moment one reaches the course, that a close view of the competing yachts is not for the majority of ordinary, or even extraordinary, spectators. For even the most influential have to bend to the wise regulations that keep all craft at a distance of miles. Only through a glass may the yachts be seen at all clearly and then not satisfactorily, appearing, as they do, merely as a couple of white sails, oftentimes too literally "in the dim distance."

But what the electrically minded voyager lost of the spectacular side of the race itself during the first trial of the Columbia and Shamrock on Tuesday, was compensated for by the courtesy to curious sightseers of Mr. Marconi and those of the New York Herald staff concerned with him in accomplishing for the first time on this side of the water a telegraphic feat that is already historical, not because what Marconi has done since his arrival in this country had not already been done by him on the other side of the water, but because he here demonstrated to the people of this country the practicability of his system. There was unanimity of opinion on board the Ponce, among the government officials and experts that had been sent to pick faults, if possible, in Marconi's work, that his system as operated to date from the Ponce is an eminently practical one, and one that will undoubtedly be of great value under certain circumstances during future naval and army operations.

The New York Herald deserves the highest commendation for its enterprise in bringing Marconi to this country, and, as Marconi was to all intents and purposes a Herald man in the matter of reporting the race, the utterances of that paper should be authentic. The following interviews with the representatives of the United States government who were on board in official capacity are taken from that newspaper. The gentlemen quoted were Lieutenant-commander Qualtrough and Lieutenant Blish, representing the navy, and Captain L. W. Wildman and Carl Kinsley of the Signal Service Department. Mr. Kinsley is a civilian, but has given much attention to the wireless telegraph, and was engaged to study and report upon Mr. Marconi's achievements. He was more than pleased with the work of the day, and at its close, when asked for an expression of his opinion, said: "My first report must be made to Captain Squier, but there can be only one opinion when it is known that 2,500 words in bulletins were sent ashore, and the total could have been greatly increased, and all of this was done without any vexatious delays or repetitions."

Lieutenant-commander Qualtrough was more outspoken. He became an enthusiast early in the day, and before nightfall was declaring his belief that the United States government would do well to persuade Mr. Marconi to install his system in the Philippines at the earliest date. "If we could only have had this last year," said Lieutenant-commander Qualtrough, "what a great thing it would have been. When we landed marines at Guantanamo the ships were unable to lend assistance, for the reason that the enemy could not be located, and by firing at random our own forces would have been placed in danger. With the aid of the Marconi system the men ashore could have directed the fire, and all would have been well. The English are prepared now to do just what I have outlined. They send a Marconi apparatus ashore with a landing party, and communication with the ship is never lost. In the Philippines the system would right now be of great service to us. It would do away with wires, which are easily cut, and it would enable us to have perfect communication between the islands. The system is certain to be made use of by the army and the navy. Even if to-day's record could not be improved upon it would be of great value. But I have seen enough to know that it is impossible to predict the limit of the wireless currents. After Signor Marconi completes the work which the enterprise of the Herald made possible, he will proceed with a series of tests and demonstrations for the government. Rear-admiral Bradford is greatly impressed with the possibilities of the discovery."

With a view of supplementing his own judgment on what is practically an unlearned subject in this country, the correspondent of the Western Electrician asked one of the most prominent government experts on board to make a statement, if possible, of the consensus of opinion among the experts on board as to the practicability of Marconi's work. The response, although the gentleman would not allow his name to be quoted, was unequivocal in its flattering nature as to the practical value of Marconi's researches. The gentleman stated that Marconi had from the start operated not at all like an experimenter, but like a man who knew his system so thoroughly that no matter what contingencies arose he always had at hand the remedies needed. He further stated, as a man familiar with telegraphic methods, that 1,500 words were sent from the Ponce at a distance, generally speaking, of from five to 20 miles with the repeating of only a very few words.

G. Marconi. William Goodbody. William Densham.

FIG. I. MARCONI AND HIS WIRELESS-TELEGRAPH SYSTEM AT THE INTERNATIONAL YACHT RACES OF 1899.—IN THE CHART-ROOM ON THE PONCE.

On Board the Ponce.

The start of the Ponce from the Anchor Line dock at the foot of Twenty-fourth street, North River, on Tuesday morning, was by no means devoid of excitement among the select few who knew something of the inner side of things. As had been generally advertised, the Herald had, very wisely for various reasons, seen fit to equip two vessels with wireless-telegraph outfits, thus practically monopolizing the wireless-telegraph instruments and experts in the city of New York. The Ponce carried Marconi, and the Grand Duchess, with W.

J. Clark, general manager of the United States Electrical Supply company, in charge, had another wireless-telegraph outfit of Mr. Clark's design. Even with all points guarded and every precaution and safeguard taken to insure success, there was considerable anxiety among those in charge of the work. It will be a surprise to many to know that from the best authority it had been learned that threats had been made by certain persons to the effect that the proposed feat in news gathering would never be accomplished. It was admitted on Tuesday night that threats had been made that if no other means were successful there might be an attempt to injure the pole or installation at the Highlands of Navesink. And a whisper, too, from one who

FIG. 3. MARCONI AT THE YACHT RACES.—CURIOUS ONES AT THE CHART-ROOM DOOR ON THE PONCE.

knew, revealed that other threats had been made of a possible attempt to disable or in some way impede the progress of the Ponce on its trip to the ocean.

All fears proved groundless, happily, for the Ponce, a little late in starting from its dock, but unimpeded, made all possible speed down the harbor and through the Narrows to the flag-boat where the Columbia and Shamrock waited the report of the starting gun.

The day was simply perfect for sightseeing, with the bright sunshine and clear, cool, bracing air, and had the wind lasted it would have been an ideal one for the race. There was, too, not enough swell to cause that old and disagreeable enemy of all ocean sightseers, seasickness; the weather god never proved

done. Marconi impressed one during the trip on the Ponce as a self-contained young man not desirous of being a prophet, but rather the reverse in his unwillingness to discuss future results. Even after accomplishing Tuesday's satisfactory work he had little to say beyond a quiet acknowledgement of a self-evident success. He "attends strictly to business," to use a common phrase, and, apparently, in a thoroughly practical manner, seeming, as one

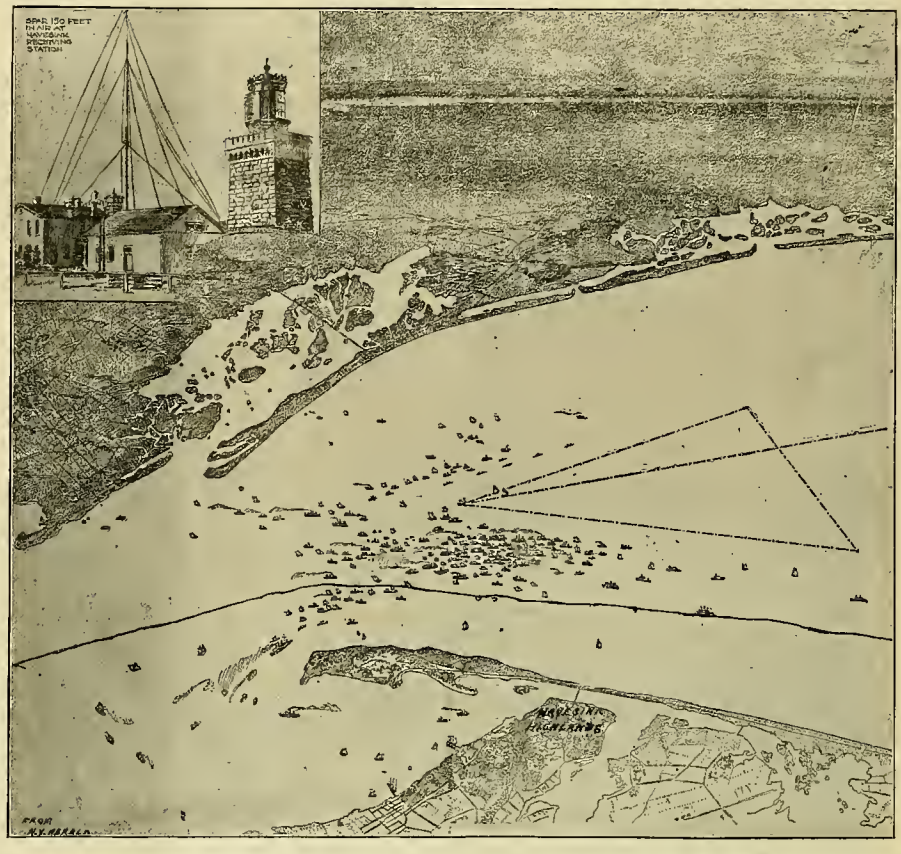


FIG. 2. MARCONI AT THE YACHT RACES.—MAP OF THE ROUTE OF THE PONCE.

of the signal officers on board the Ponce put it, "always to know from experience just what to do in every emergency and to do it promptly." As a matter of course, the man must have felt the weight of some responsibility on this, the occasion of his first appearance in the United States, but while his manner during the tests was at times a little brusque, anyone that saw the incessant

thus besought him was entirely commendable and that his patience was quite remarkable, particularly when one remembers also that, being a foreigner, he is entirely unused to American newspaper methods, that sometimes display an energy that becomes an unpleasant aggressiveness. Fig. 3 is reproduced from the Herald, as it is a true picture, showing how many curious ones constantly hugged the temporary fence that barred the way to the chart-room with eyes at the window and the door to see Marconi and how he "did it."

As Marconi, for so young a man, has made a really wonderful accomplishment in advancing methods of communication, the accompanying pictures in the Western Electrician showing him as he appears under different circumstances will perhaps prove of interest. Fig. 4 is an excellent near profile view of Mr. Marconi, as he sat upon the deck of the Ponce. This is an unusual picture, in that it shows Mr. Marconi in repose. No better idea, however, can be had of Marconi and his three clever young English assistants than that given by Fig. 5. To the left in this picture, which shows

FIG. 5. MARCONI AND HIS ASSISTANTS.

himself more generous. Fig. 2, as shown above, is reproduced from the Herald for the benefit of those not familiar with the map of the lower bay of New York. The black line across the map shows approximately the course of the Ponce as it progressed after the yachts and along the Jersey coast.

Marconi and His Assistants.

Mr. Marconi and his assistant, Mr. W. Densham, worked steadily throughout the entire day, taking turns in the chart-room, where the sending was

pestering of the inventor at almost every move must have conceded his wonderful patience, exhibited under trying circumstances. Government officials were always around, as were newspaper writers, artists and photographers, and not a few ladies. All were greatly interested, but each had his or her particular "ax to grind"—a telegram to the land, a trivial question or something of a similar trifling nature, perhaps. Everybody had something for Marconi to do, forgetful of the pressing requiremens of the work in hand. Be it said to the credit of Marconi that his courtesy to the throngs that

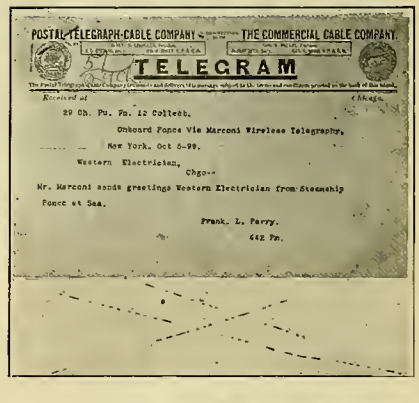


FIG. 6. MARCONI WIRELESS-TELEGRAPH SYSTEM.—A MESSAGE FROM THE PONCE AT SEA.

the four men glancing over maps in the uptown Herald office during their preliminary survey of New York harbor, sits Marconi; next in line appears Charles E. Rickard, then W. W. Bradfield, and last, but not least, William Densham. It was the last-named gentleman who relieved Mr. Marconi the greater part of the time at the sending and receiving apparatus on the Ponce during the telegraphing on Tuesday. This picture is reproduced through the courtesy of the New York Herald, which journal and its representative, Mr. Redding, extended to the Western Electrician correspondent many courtesies, enabling him to secure photographs during such a busy time.

The Apparatus Used.

Relative to securing information as to the electrical details of Mr. Marconi's apparatus, it will

perhaps not be a surprise to many to learn that it is plainly evident that Mr. Marconi realizes that the best patent an electrical man can have is, perhaps, one not yet issued, or a device guarded by a tightly closed mouth. The man interviewing Marconi or entering the chart-room of the Ponce with the ex-

FIG. 4. MARCONI AT THE YACHT RACES

pectation of having revealed to him the fine points in the Marconi wireless-telegraph apparatus went away disappointed. It is safe to say that even the government officials and other scientific men, posted on ship in search of information and given every opportunity to inspect generally, but not to take apart, will confine their reports to expressing themselves on results witnessed rather than to methods and mechanism employed in producing such results.

The photograph reproduced in Fig. 1 (page 213) is of peculiar interest, as it was taken on Tuesday afternoon by flashlight, a short time after the word "no race" had been passed down from the bridge, and Marconi is "sending," not posing for the photographer. In this photograph Marconi's manager, Mr. Goodbody, appears in the background, while Mr. Densham stands just back of Marconi, waiting to relieve his chief.

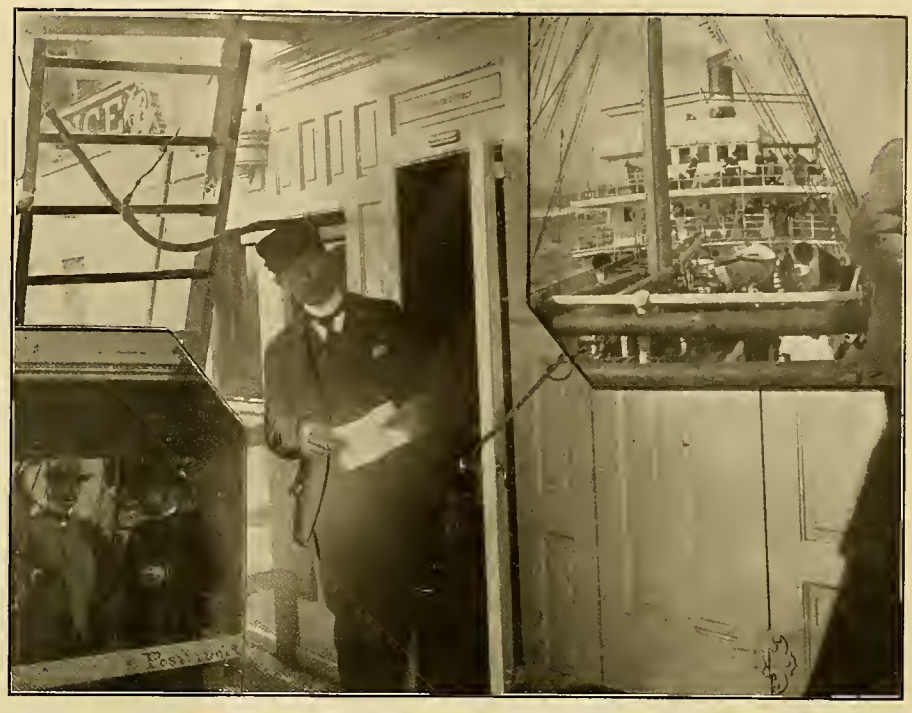
The Marconi key is not a telegraphic key in the strictest sense, but is somewhat similar in appearance. It is a longer lever (about 14 to 18 inches) pivoted at about its middle in a similar manner to a telegraphic key, but instead of a finger button there is a handle extending upward about three inches, for the operator. This key is swung up and down over a wide gap in order to break the spark of the induction-coil primary circuit, which it controls.

The induction coil is described as one capable of giving, say, a maximum spark of 10 inches. During the sending from the Ponce on Tuesday the gap between the spherical terminals of the coil, and hence the spark employed, was about one inch in length. The knob terminals and the spark between are indicated graphically in Fig. 1 in the little sketch from the Herald in the upper right-hand corner. Mr. Marconi's operator and assistant, Mr. Densham, was willing to state as an interesting point that the spark length was varied under different conditions of sending and to suit different circumstances.

During the process of sending the iron-cased receiving instrument, which appears in Fig. 1 to the left, is cut out by what appears to be a simple wire "jumper." As a matter of course, these mysterious iron-cased boxes thus protected, it is understood, from stray "waves," are an object of curiosity to anyone electrically posted. For one cannot help feeling that within this boxed portion of Marconi's apparatus lie the clues to all the young Italian's best work.

During the receiving a close listener fails to detect what would be expected from a familiarity with one sort of receiving apparatus used in this country; that is, a decided vibration of the coherer. One hears merely the faint "click," "click" of what might be the armature of, say, a delicate relay. There seems also to be no method of revolving the coherer, at least nothing that gives out sound. This is the extent to which the ordinary observer sees into Marconi's apparatus. But results are free to all, and these appear in "Continental" or "International" Morse characters, as shown at the bottom of Fig. 6, a photographic reproduction of a piece of the tape on which messages on Tuesday were received on the Ponce, with a reproduction of a message from the Ponce at sea telegraphed to the Western Electrician at Chicago.

Relative to the external arrangement of Marconi's equipment on board ship, the pictures (Figs. 7 and 8) show different views of the Ponce, the latter picture being taken from the stern of the vessel. Glancing to the top of the foremast, it is easy to distinguish the vertical wire as it is hung from the



Capt. Wildman. Lieut. Blish. View on the Ponce.

FIG. 9. MARCONI AT THE YACHT RACES.

FIG. 7. MARCONI AT THE YACHT RACES.—THE STEAMSHIP PONCE FITTED WITH WIRELESS-TELEGRAPH APPARATUS.

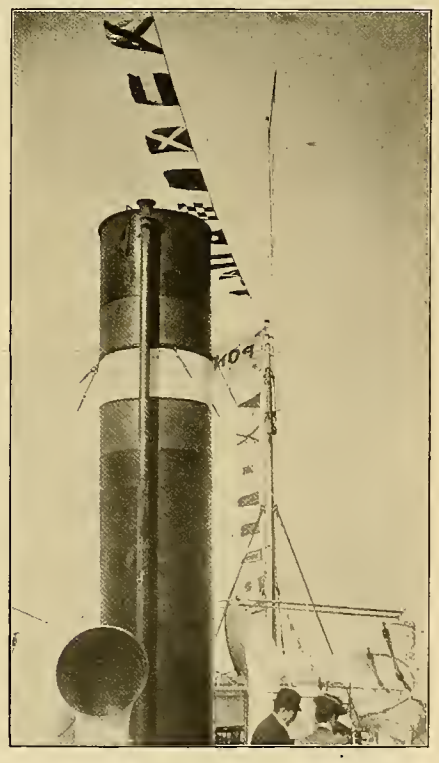


FIG. 8. MARCONI WIRELESS-TELEGRAPH SYSTEM—MAST AND VERTICAL WIRE ON THE PONCE.

extra topmast that is slightly inclined from the vertical. It may surprise some to know that the Marconi vertical conductor is simply a black insulated wire, or, more strictly, a cable consisting of seven No. 20 copper wires or strands. This conductor is estimated at 150 feet in length, and is simply dropped from the little topmast down into the chart-room window, which is under the bridge and just back of the wheel house. The manner in which the conductor enters the chart-room is clearly shown in Fig. 9. In this illustration it will be noticed that as the wire approaches the deck and as it enters the chart-room the insulation is made extra heavy by rubber tubing and guttapercha stretcher insulators. The need for this was appreciated after repeatedly hearing the common warning of the

FIG. 10. MARCONI WIRELESS-TELEGRAPH SYSTEM.—"GROUND CONNECTION" ON THE PONCE

operator in the chart-room, "Keep your head away from that wire!" This picture shows Marconi coming out of the chart room.

The "ground" connection, Fig. 10, employed by Mr. Marconi is simply a bare copper wire, about No. 6 gauge, run carelessly across the chart-room floor out onto the deck and over the side of the vessel down to the iron guard rail on a lower deck, where it is wound around a support of the deck and then clamped by a nut around the end of a bolt in the iron framework of the vessel.

Operation of the System.

Mr. Marconi during the day was caught "on the run," so to speak, and was asked to express in a rough way on paper his conception of the Hertzian wave that comes from the vertical wire hanging from the mast. A card had been prepared by your correspondent with a pencil sketch of the diagram here shown in Fig. 11, supposed to represent an upright pole or mast from which hangs the Marconi vertical conductor. Quick as a flash Marconi seized the pencil and by a single down-and-up stroke made the two "wave marks" shown in Fig. 12, and with the words "Long waves—like that," was off.

As Mr. Marconi was not available, Mr. Densham was afterward asked to explain this diagram more fully, and he stated that Fig. 13 gives a more correct idea of the way the Marconi people conceive the theoretical appearance of the wave. But just how the wave might start from the wire was a question. Mr. Densham stated further that practice seemed to prove that the wave was about four times the length of the wire, as indicated in the diagram. Remembering, therefore, that the general standard height of the vertical wire now employed by Marconi is 150 feet, this would make the wave, say, 600 feet as it leaves the 150-foot vertical conductor.

Mr. Densham was asked what was the effect of an increased spark length or electromotive force; whether the length of a spark gave an increase of the distance reached by a message. His answer was to the effect that it made very little difference after certain points.

The Marconi people were questioned as to the methods likely to be employed by Mr. Marconi in the line of directing the Hertzian waves, but the answer came with a smile that on this subject they "had nothing to say."

Incidentally, it should be recorded that the first message sent by the Marconi system of wireless telegraphy in the United States from on board steamship Ponce was by Marconi on September 29, 1899, as follows:

V V V.
R U there?
M M yes; here.
M Stand bi a mo.

(Signed) G. MARCONI.

During the voyage down the bay on Tuesday stock quotations were received on the Ponce and a number of private telegrams sent to land, to be

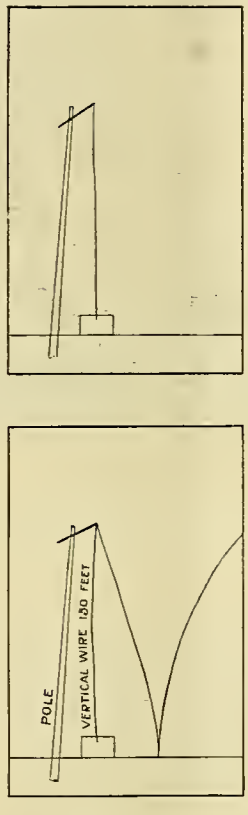


Fig. 11.
Fig. 12.

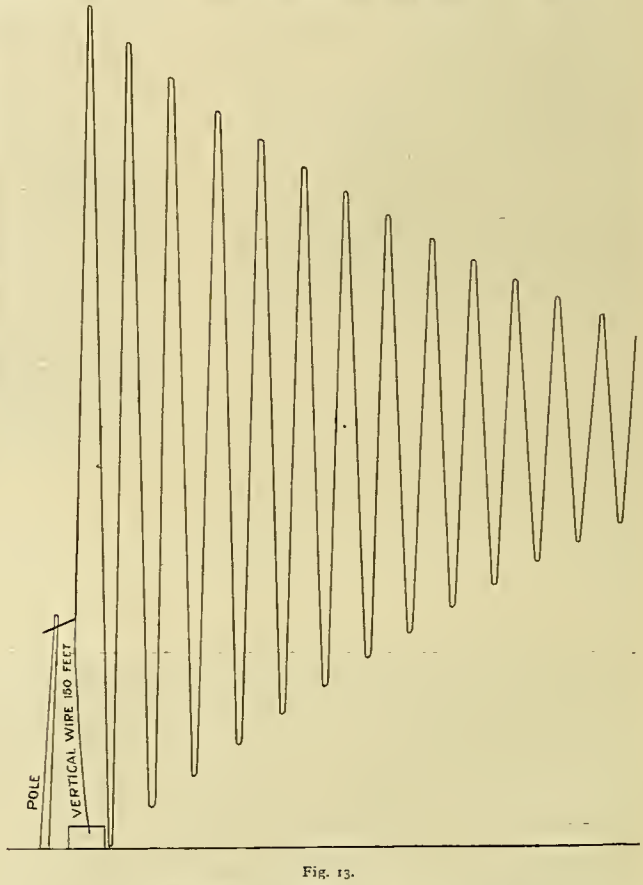


Fig. 13.

MARCONI WIRELESS-TELEGRAPH SYSTEM.

received at the station in charge of W. W. Bradfield at the Highlands of Navesink.

According to Mr. Redding's report in the New York Herald, as the yachts got away the following message, the first concerning the actual race, was written, and in less than 90 seconds was public property in New York:

Race under way, both yachts flying mainsails, club topsails, spinnakers, staysails, jib and jib topsails. Running before wind down the Jersey coast. Wind about eight knots and freshening.

Following this were bulletins giving more accurate descriptions of the work being done, and there was joy on the Ponce when word came back that everything was working so perfectly that only a very few seconds separated the chart-room within which the sending was being done and the office of the Herald.

During those early moments of the race when favoring winds filled the sails of the challenger while the cup defender was floundering a bit uncertainly in the smooth sea, every breeze was described. The fifth bulletin read thus:

Shamrock apparently leading slightly. Both hallooo jibs spilling wind, but Shamrock's sail is drawing the better. Course clear.

It required, says the Herald, one minute and a quarter to send this dispatch, yet the first three words, "Shamrock apparently leading," were received in New York and given out as a separate bulletin before the last word, "clear," was sent.

Whenever the Marconi bulletins were posted the public was less than 75 seconds behind the yachts and in many cases less than 30 seconds.

In Chicago the wireless-telegraph bulletins were posted by the Times-Herald, which had a telegraph operator and instrument in front of its building on Washington street. The time elapsing from the sending of the bulletins on the Ponce, at sea, off the Jersey coast, and the posting of them in Chicago was from three to seven minutes. The distance, by space and wire, was about 950 miles.

Among the passengers on board the Ponce during the several trips with Marconi were Mrs. George Westinghouse and Mr. Frank J. Sprague, the lat-

ELECTRICAL DECORATIONS IN NEW YORK.

ter spending Wednesday on the boat. Mrs. Westinghouse sent a "wireless" telegram to Mr. Westinghouse in Pittsburg. In its report of Thursday's trip the New York Herald states that several messages were received on the Ponce. One for Mrs. George Westinghouse, in answer to the one mentioned, read thus:

Mrs. Westioghouse:
Message delivered. I hope you will have a delightful day. My compliments and congratulations to Professor Marconi and the Herald representative, to whom I feel indebted for the courtesies of Tuesday and to-day. WESTINGHOUSE.

Frank J. Sprague was out of the chart-room of the Ponce for only a very few minutes of the trip. He declared himself to be greatly impressed with the achievements of Mr. Marconi. "He is a genius," said Mr. Sprague, "and the Herald is to be congratulated upon its enterprise. As usual, it is the first to take up and exploit anything in the world of practical science that is worth exploiting. Mr. Marconi is far in advance of all others in his particular line. He is a genius possessed of sound judgment. I have no doubt that he could send a message from here to San Francisco were it necessary. On the other hand, I don't believe it will be necessary. The wireless telegraph will create a field for itself, just as the electric light did. At one time it was feared that gas was to be driven from the field, but it has not been. So the wireless telegraph will make its own field a broad one without disturbing present plants."

ACKNOWLEDGMENTS.

The Western Electrician acknowledges the excellent assistance rendered it by Photographer L. Doty Brown of New York and also Benjamin A. Howes, official photographer for the Sprague Electric company of New York, who acted in the same capacity on the Ponce. Both Mr. Brown and Mr. Howes did excellent work. To. Mr. A. J. McIntosh, manager of the Ponce during its yachting trips, the correspondent is particularly indebted, as every possible facility was extended.

Electrical Decorations in New York.

To welcome Dewey the corporation and citizens of New York made elaborate decorations and illuminations, and the electric light was lavishly used. The most conspicuous feature was the "Welcome Dewey" sign on the Brooklyn bridge, shown on page 216. This was truly gigantic. The letters were 36 feet high and the two words were 370 feet long. In the letter W there were over 1,000 lights, and the whole sign is said to have contained 8,000 16 candle power lamps. The lamps were suspended between poles placed on the southern roadway and held in position with the aid of wire guys. The lamps were connected five in series, the 550-volt current being taken from the contact rails of the Bridge electric railway. The lamps used were not provided with bases, but consisted simply of the glass bulbs, with short leading-in wires. The butt of each lamp was stopped with a cork, and the whole was covered with shellac. Wires were twisted about the lamps to steady them to prevent wind breakage.

On the tops of the bridge towers were placed 30-inch searchlights from the New York navy yard, operated by men of the Brooklyn battalion of the Naval Militia. To reach the tops of the towers the men had to climb up rope ladders outside the towers, which are 278 feet high.

Electrical Illumination at the Chicago Festival.

The decorations for Chicago's Fall Festival just ended represented a distinct advance over previous attempts of the same character. The "Court of Honor," on State street, between Lake and Van Buren streets, where most of the decorations were centered, was artistic in conception and pleasing in execution. At Van Buren street was erected a massive arch with heroic figures, representing education and industry, and at the Lake street entrance to the court were built two large pylons, also adorned with representative figures. Along the sides of the court, spaced 80 feet apart, were Venetian masts, and rostral columns marked the corners of the street intersections. These masts and columns were graceful in themselves, but the lavish use of incandescent lamps gave the court a particular brilliancy after nightfall. While the electrical features of this year's decorations were not as extensive as those of last year during the Peace Jubilee, they gave a more beautiful and tasteful effect.

FIG. 1. ELECTRICAL ILLUMINATION AT THE CHICAGO FESTIVAL.—COURT OF HONOR AT NIGHT.

Festoons of incandescent lamps were hung from supports stretched across the street to the masts on either side, while at the street intersections two festoons were crossed diagonally from the corner buildings. An excellent idea of the arrangement is given in Fig. 1. From 85 to 100 lamps were strung on each festoon, about 5,000 lights being thus used between Lake and Van Buren streets. The festoons were suspended from the center, 58 feet above the street pavement, by means of two galvanized-iron wires, No. 6, B. & S. gauge, the wires being fastened to the buildings on opposite sides of the street. The work of construction consumed but 10 days.

Rubber-covered wire was used throughout for the electrical wiring. The lamps were of clear glass and 16 candle power each, and were protected from the weather by inverted tin cups in the same manner as the lamps used for the street decorations at the time of the Peace Jubilee a year ago and described in detail in the Western Electrician at the time. Current was furnished from the street mains of the Chicago Edison company and was controlled by four knife switches in each block, placed in storm boxes in front of the buildings. It is stated that the current for the entire 5,000 lights was switched each evening by four men in the short time of 1½ minutes.

Searchlights were used to play on the arch at Van Buren street and the pylons at Lake street, two being placed on the buildings near Jackson boulevard and two near Randolph street. These lamps had 13-inch lenses, were of 10,000 candle power each, required 20 amperes of current at 110 volts and were made by the General Electric company.

At the height of about eight feet above the sidewalk, on each of the Venetian masts and columns were placed four gas flambeaux. There were over 300 of these used and each consumed 250 feet of gas an hour.

Fig. 1 is a night view of the Court of Honor looking south on State steet from Randolph street. The searchlights for the north end of the court are seen at the left of the picture.

The Court of Honor was first lighted on Wednesday evening, October 4th. The illumination was continued each night of the festival week, between the hours of 5:30 and 11:30 p. m.

The private electric-light designs were numerous and elaborate. Nearly every building facing the Court of Honor was lavishly decorated with flags and bunting and illuminated at night with electric lights. The Hub, the Fair, Siegel, Cooper & Co.'s, Mandel Bros. and the Union Loop displayed the most striking electrical decorations on State street, while the Board of Trade, Union League Club and Chicago Tribune were among the best decorated buildings on other streets. It is estimated that upward of 12,000 lights were used in private displays in the Court of Honor.

Fig. 2 is an illustration of the front of Mandel Bros.' building at the corner of State and Madison streets, taken at night. Admiral Dewey's flagship, the Olympia, formed the principal design. The ship was 56 feet in length and had an extreme height of 54 feet, extending over four floors. A line of footlights below the ship was composed of 105 16 candle power incandescent lamps. The ship itself was outlined by 720 eight candle power lamps, 200 red-bulb and 150 blue-bulb lamps being used. A 10,000 candle power, 35-ampere searchlight was placed in the pilot-house of the ship. Portraits of Dewey and McKinley were outlined by incandescent lights. A total of 1,113 incandescent lamps, all of 16 candle power, except those on the ship, were used on the exterior of the building. The power was furnished from the private plant of the building and the electrical features of the decorations were designed by the engineers of the firm.

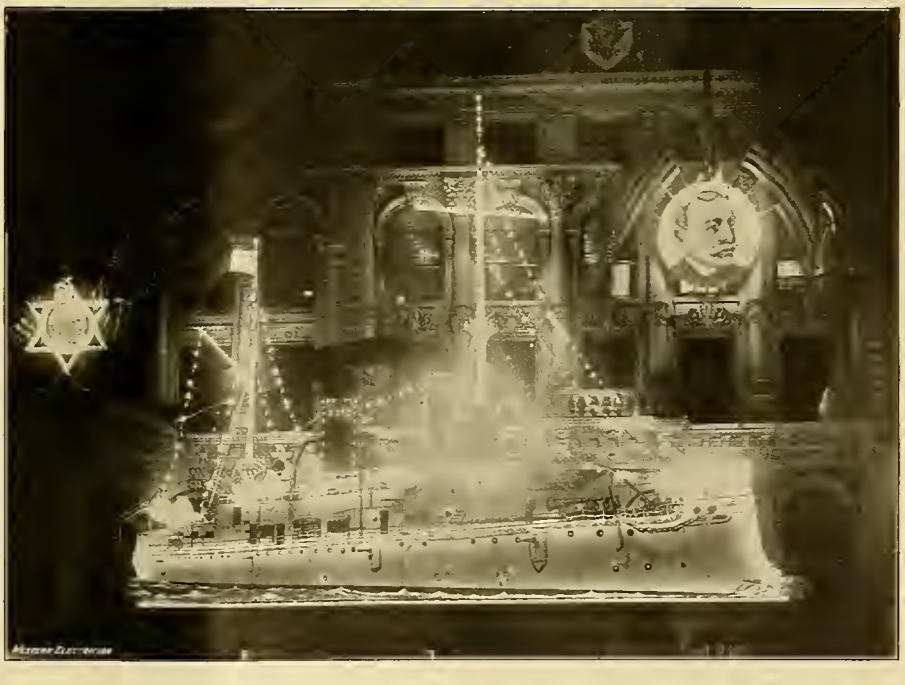


FIG. 2. ELECTRICAL ILLUMINATION AT THE CHICAGO FESTIVAL —THE OLYMPIA ON A STORE FRONT.

The lowest bid received by the War Department for the installation of an electric-light plant at Napatree Point, R. I., was that of B. O. Ellis of New York. The amount of the bid was $1,451.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
Suite 510 Marquette Building, CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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France and England have been telephonically united for some years, and now it seems that all preliminaries have been settled and that telephone communication will be opened between Paris and Berlin. The distance between the two cities is about 750 miles, and the line will probably be the longest talking circuit in Europe, the St. Petersburg-Moscow line now enjoying that distinction. Perhaps the new avenue of communication will serve to draw the Germans and the French closer together, although when one reflects that the line under the English Channel has had no effect in softening Anglo-Gallic antipathies, the hope becomes a faint one. At any rate, the extension is an industrial advance, and as such will be welcomed. Whatever increases the means of communication between the nations of the earth must, in the end, make for progress and enlightenment.

Electric fountains have spouted their illuminated waters in the United States and France for a decade and over, but they appear to be a novelty in England to judge by the attention paid by the London newspapers to three that were started at the Crystal Palace during the summer of this year. Perhaps the new fountains are exceptionally fine. They should be good, because they were designed and erected by an American who has had considerable experience with such decorations, and the electric pumps that supply the water are of American make.

Incandescent-lamp makers will be interested in the statement that a Frenchman, L. C. Dumas, has discovered that an alloy of nickel and steel has practically the same coefficient of expansion as glass, and may be used as a substitute for platinum in the leading-in wires of lamps. The proportion of the metals is said to be: Nickel, 45 per cent.; steel, 55 per cent. The exact composition of the steel is not stated. If this statement proves to be true, it will be of considerable importance to manufacturers of lamps, although it will hardly make the difference in price that some non-technical publications seem to expect.

Pollak and Virag's method of quick telegraphy is exciting considerable attention on the continent of Europe, and it is said that messages have been exchanged between Budapest and Berlin at the rate of 70,000 words an hour. This is, of course, a great improvement in speed over ordinary telegraphy; but it is likely to prove that while the actual sending of the electrical signals is much faster than the common methods, the advantage will be lost in great measure, if not fully offset, by the time and complication of making the messages ready for the wire and of translating them into a written language at the receiving end. This has been found to be the great objection to these "marvels of telegraphy" heretofore, and is the reason why the Wheatstone system is in comparatively restricted use in this country.

Some criticism has been directed toward the language of the resolution recently adopted by the League of American Municipalities in accepting the offer of a joint investigation of municipal electric-lighting plants, made by the National Electric Light association. The association, in its proposal, suggested public plants as the subject of investigation, but the league accepted on the condition that private installations be included also. On this point the resolution provides that the investigation is to extend to "the charges for domestic, commercial and street lighting, the cost of coal, the wages and hours of labor in private companies whose conditions are as similar as may be to those of the public plants examined." It is objected that if this provision is literally construed, data of importance will be excluded and the investigation will be a useless one. Nothing is said in the resolution about the depreciation of plant, taxes, water supply and other items that should fairly enter into the comparison. But it is to be hoped that the two investigators, when appointed, will approach the subject with broad-minded and judicial spirit and endeavor to present a body of facts of real value. Neither side should be afraid of the truth. Let us have the facts.

When a community is infected with the municipal-ownership idea some of the people in it get queer notions. Wyandotte, Mich., is such a place. It wants to know more about a municipal electric-lighting venture that is proposed there, and naturally, being near Detroit, applied to Alex Dow for information. Mr. Dow has studied this municipal-lighting question from both sides of the fence and ought to know something about it. The questions were startling. The Wyandotte people wanted to know if it was possible for an electric-lighting plant, with subscribers for 4,000 incandescent lights, to be used, without restriction, with all-night service every day in the year, with rates at 25 cents a month for the first four lights, and all subsequent lights at 10 cents a month; and would it be possible to furnish 50 or 60 arc lights of 2,000 candle power and have profits of the incandescent lights pay entire costs of the lights upon the streets?

Mr. Dow's answer was characteristic. "No," he said; "it would not be possible as long as the city pays for its materials and labor, and has ordinary men (not angels) for customers; and to the second proposition, utterly and absurdly impossible."

The questions were also put to William H. Fitzgerald, who thus answered: "I can scarcely conceive the existence of such conditions as would enable a public or private corporation to supply electric-lighting service on the terms proposed. I consider the proposition very impracticable. The second question requires no answer. It is ridiculous."

Dr. Langlois, president of the Wyandotte Board of Public Works, insists, however, that when the municipal plant is completely finished, it will be self-supporting, and that the streets will be lighted free of cost when subscribers are had for 4,000 lights. Verily, the calculations of some of the municipal-ownership advocates are as strange and weird as glimpses of the moon.

Mr. Marconi and his associates are to be congratulated on the entire success of their work in transmitting bulletins of the international yacht races to the shore, from a vessel moving along the course, by space telegraphy. A complete account of this interesting accomplishment is given in this issue of the Western Electrician. By the use of the Marconi system messages from the Ponce, the vessel fitted with the apparatus, were received in New York within from one-half to two minutes of the time of sending on the steamship on the course. In Chicago the elapsed time of messages in transit from the Ponce was from three to seven minutes. In London bulletins were received 15 minutes after sending from the steamship. Thus the Marconi messages beat the dispatch boats fully an hour in time, besides sending a constant succession of bulletins from the center of interest on the water. No extended use of carrier pigeons appears to have been made, although this method had been used in former years. Marconi has sent messages at longer distances than those that obtained off the Jersey coast, but never before had he shown the value of his system in such a practical manner to so large an audience. The New York Herald, which, with the Chicago Times-Herald, employed Mr. Marconi, is entitled to all the renown which its enterprise has won for it. Some of the New York newspapers seemed to be jealous of the Herald's coup, but in general American journals and journalists will rejoice at the successful demonstration of a decided advance in methods of transmitting news.

One valuable example of the usefulness of space telegraphy grew out of the rumor that one of the large excursion boats, the Grand Republic, had sunk in the Lower Bay with 2,000 people on board. Without the Marconi system there would have been no immediate means of confirming or contradicting the news, and many persons would have been greatly distressed. The New York Herald telegraphed the rumor to Marconi, who immediately answered that the Grand Republic was all right; that he could see her and that she was going into the harbor. This dispatch was, of course, given the greatest publicity and allayed much anxiety.

The assertion that Prof. A. E. Dolbear of Tufts College is the original inventor or discoverer of space telegraphy was put forth during the use of the Marconi system at the yacht races. It is said that Professor Dolbear has a broad patent on the art of transmitting messages electrically without wires and that Marconi is an infringer. Legal proceedings against the Italian are spoken of, although no actual complaint appears to have been filed in court as yet. Professor Dolbear says that he sent telegraph messages without wires as far back as 1885 and 1886, near Boston, for distances up to a mile and a half. But the fact remains that Marconi is the man who made space telegraphy practicable and a wonderful success. If a Dolbear system had been available, the New York Herald would hardly have sent to England at great expense for men and instruments to do the work.

Marconi's Wireless Telegraphy.[1]

By W. B. Bradfield.

As is, of course, well known, the Marconi system is worked by means of Hertzian waves, so called after the late eminent German professor, Heinrich Hertz, who first experimentally proved their existence 30 years or so after Clerk Maxwell had mathematically predicted them.

At his New Jersey station Mr. Marconi employs the following apparatus to generate and collect these waves: The first thing that is apparent to the observer is a tall mast, 150 feet high, from the top of which is suspended a wire—it is actually an ordinary insulated copper wire, such as is used for electric-lighting purposes—which passes through a window of the operating room and is joined up inside with the apparatus. There is nothing strange in the appearance of the mast itself, and no effort is made to clothe this part of the apparatus with mystery. With regard to apparatus within the room, simplicity is the most amazing part of it. The whole apparatus is fixed on a small table about four feet long and two feet wide, and the battery for supplying the power is packed underneath it.

This battery consists of 98 dry cells, which are connected up 14 in series, and seven in derivation, and is joined up in parallel with eight accumulator cells to give a steady current of six amperes. The actual generator of the waves is an ordinary inductor or Ruhmkorff coil, such as is used for the production of X-rays, and is capable of giving a 10-inch spark. Each end of the secondary winding of this coil is fitted with a sparking rod, to which is attached a brass ball 1½ inches in diameter.

To one of these balls is connected the vertical wire; the other is joined to earth. With the single addition of a Morse key in the primary circuit the transmitting apparatus is complete.

Consider for a moment what happens when this key is depressed. The immediate and apparent result is a loud, crackling spark discharge between the two brass balls, which are adjusted to be about two centimeters apart. The more important result is that the vertical wire at the moment the spark passes emits waves which go out into space in all directions, and continue to do so as long as the key is depressed. It is quite easy to understand, therefore, that by depressing the key for a short or a long period short and long series of waves or oscillations are emitted, and the Morse alphabet, which is used in ordinary telegraphy, may be employed.

The only thing that remains is to get something that will pick up and indicate the presence of these oscillations.

The apparatus which Marconi employs to do this is what is commonly known as a "coherer," a name which is due to Professor Oliver Lodge of Liverpool. An Italian, named Calzecchi, was the first to discover the sensibility of coherers and filings tubes to Hertz waves. He found that metallic filings in a loose state of contact offered an appreciable resistance to the passage of a current. He found also, however, that on exposing these filings to the action of Hertzian waves the resistance fell enormously, but that on shaking them up the resistance was increased again to its original value. Marconi's coherer works on the same principle, but is vastly more sensitive and reliable than those used by Calzecchi, Branly and others.

It consists of a small glass tube about two inches long, in which two small silver plugs a quarter of an inch long are tightly fitted and separated from each other by about one-thirtieth of an inch, the gap between them being partially filled with a mixture of nickel and silver filings, these metals having been found to be the most sensitive and reliable after a long series of experiments. The coherer is exhausted to a vacuum of four millimeters.

So much for the coherer. The rest of the receiving apparatus is perfectly easy to understand. In circuit with the coherer is a single dry cell and a telegraphic relay of the ordinary type. This relay is used to close the circuit of a local battery, which works a Morse writing instrument, and also an electric bell hammer, which strikes the coherer a smart tap to restore it to its normal high resistance after it has received an impulse from the distant transmitter.

To protect the coherer from the too powerful effects of the local transmitter the whole receiver is enclosed in a metallic box.

To receive a message all that is now necessary is to connect the vertical line either directly or through a small induction coil to one end of the coherer, the other end of it being connected to earth.

Such is the Marconi apparatus in use at the Herald's New Jersey land station, and it is in exact duplicate aboard the steamer Ponce. She has been specially rigged with a new topmast to give the same height of wire as that at the land station, and the instruments are installed in the chart house.

The distance that will have to be bridged will probably not exceed 35 miles; the apparatus employed would, however, be capable of sending and receiving messages at a distance of nearly 80 miles.

The chief factor in determining the distance possible is the height of the vertical wire. Mr. Marconi finds that by doubling the height the distance becomes quadrupled. That is, assuming 20 feet will give one mile, 40 feet will give four miles, 80 feet 16 miles, and so on. There are, of course, other factors, such as the sensitiveness of the coherer and the adjustment of the apparatus generally, but apparently they are not so marked in their effects.

Why this vertical wire is necessary for long distances is not very certain. It has been suggested that the earth's curvature may have something to do with it. Compare this, however, with Mr. Marconi's results in the English naval maneuvers this summer, when with 150 feet of wire at each end he succeeded in telegraphing 75 miles. To do this the waves must have passed through a "hill" of water 35 miles long and 700 feet high. More probably, the vertical wire is necessary because its use lengthens the waves and propogates them in a plane vertical to the surface of the earth, and they are, therefore, less likely to be absorbed by it. The fact that the waves are lengthened, of course, causes them to be more penetrative and capable of affecting a receiver at a greater distance.

Of the working of a wireless-telegraph station there is not much to say, as it is essentially the same as that of any other telegraph office. At present the speed of transmission is rather less; it does not ordinarily exceed about 15 words a minute, but this will, of course, increase with time. A call is indicated by a bell which is switched off during the reception of a message. As before stated, the telegrams are printed in dots and dashes on an ordinary Morse inker, the operator having merely to read them from the tape.

The key used is of a slightly different form from the usual Morse key, the back contact being used to connect the vertical wire to the receiver, so that no changing over from the transmitter to the receiver is necessary after sending a message.

1. From the New York Herald. Mr. Bradfield is Mr. Marconi's assistant.

Lieutenant Brumby's Opinion of Electricity on Warships.

During the recent Dewey celebration in New York a representative of the Western Electrician succeeded in getting an expression of opinion from Lieutenant Brumby, Admiral Dewey's "right-hand man," on the value of electrical appliances during the naval battle in Manila Bay. The lieutenant's opinion was a decided and unequivocal one. In answer to the newspaper man's question, "What was your opinion of the part played by electricity in the sea-fight at Manila?" the officer said, in an emphatic manner: "Electrical apparatus played a very insignificant and unimportant part on board ship, and almost every electrical appliance was useless." A moment later, however, Lieutenant Brumby qualified this broad statement by saying that there were but few electrical appliances on board the Olympia; but those that were installed did not operate satisfactorily. He added: "There is no reason, however, why electrically operated devices should not be important adjuncts in the operations of naval vessels, if they were only made strong enough."

It should, perhaps, be stated that this was an offhand opinion, given at a time when the speaker was very busy attending to the details of Admiral Dewey's departure for Washington. It would be interesting to know just what types of apparatus met the lieutenant's condemnation owing to their weakness. And a critical opinion of the value of searchlights, in particular, would have been of value. In Cuban waters the searchlight was certainly an almost indispensable accessory. But the admiral's assistant had but a minute to spare, and a detailed conversation was impossible. His tersely expressed opinion shows, however, that in the opinion of one naval officer, at least, electrical appliances have not come up to expectation. But since the Olympia was fitted considerable advance has been made in the application of electrical power on board ship, and it may be that the gallant lieutenant will yet be led to change his opinion.

Dolbear versus Marconi.

It is interesting to observe that at the time Marconi reported the yacht races very successfully for the New York Herald, the World and other papers of the happy journalistic family in New York had much to say about the claims of Professor A. E. Dolbear of Tufts College, who asserts that he discovered, or invented, space telegraphy away back in 1885, and has a broad patent to show for it. Mr. Marconi makes light of Professor Dolbear's claim. An arrangement was made by which the Dolbear patent was not pressed during the yacht races. Professor Dolbear's son is thus reported: "We are ready to fight this thing to a finish. If Marconi undertakes to conduct experiments for the Navy Department we will at once bring action against him. He will find himself hemmed in on every side. The men who are back of us are fighters and have ample capital. Our patent, issued on October 5, 1885, covers the entire ground. It is for the art of wireless telegraphy. It does not matter what instruments or methods are used. Just as soon as anybody gets into the field of wireless telegraphy or telephony he is poaching on our preserves."

Marconi says that he has taken advice and does not fear the Dolbear patent. He is going ahead with his work in this country, he says.

The Anderson & Middleton Lumber company of Aberdeen, Wash., has applied for a franchise for an electric-light plant.

Electrical Achievement in Retrospect.

In the presidential address to the British Association last month Sir Michael Foster reviewed the scientific progress of the closing century. Considering particularly electrical development, he said: "At what time did this bright child of the nineteenth century have its birth? He who listened to the small group of philosophers of Dover, who in 1799 might have discoursed of natural knowledge, would perhaps have heard much of electric machines, of electric sparks, of the electric fluid, and even of positive and negative electricity, for frictional electricity had long been known and even carefully studied. Probably one or more of the group, dwelling on the observations which Galvani, an Italian, had made known some 20 years before, developed views on the connection of electricity with the phenomena of living bodies. Possibly one of them was exciting the rest by telling how he had just heard that a professor at Pavia, one Volta, had discovered that electricity could be produced, not only by rubbing together particular bodies, but by the simple contact of two metals, and had thereby explained Galvani's remarkable results. For, indeed, it was in that very year, 1799, that electricity as we now know it took its birth. It was then that Volta brought to light the apparently simple truths out of which so much has sprung. The world, it is true, had to wait for some 20 years before both the practical and the theoretic worth of Volta's discovery became truly pregnant, under the fertilizing influence of another discovery. The loadstone and magnetic virtues had, like the electrifying power of rubbed amber, long been an old story. But save for the compass, not much had come from it. And even Volta's discovery might have long remained relatively barren had it been left to itself. When, however, in 1819, Oersted made known his remarkable observations on the relations of electricity to magnetism, he made the contact needed for the flow of a new current of ideas. And it is, perhaps, not too much to say that those ideas, developing during the years of the rest of the century with ever-accelerating swiftness, have wholly changed man's material relations to the circumstances of life, and at the same time carried him far in his knowledge of the nature of things."

Chicago Elevator Ordinance.

If an ordinance passed by the Chicago City Council on October 5th becomes a law, all elevator operators will be required to be licensed. The ordinance provides for a board of examiners, appointed by the mayor, to consist of two competent, practical men engaged as elevator conductors and one practical man engaged in the business of building elevators or elevator safety appliances. This board shall issue licenses, after examination, and prosecute violations of the ordinance. There are two classes of licenses—for registered conductors and for registered apprentices. The former must be 21 years old or over and the latter not less than 18 years old. The fee for conductors' licenses is $2 and for apprentices 50 cents. No elevator, passenger or freight, may be operated by a person not licensed. Apprentices are allowed to operate elevators only under the eye of a registered conductor for a period of six months from the date of the certificate. Penalities are provided against both elevator operators and building owners or lessees who infringe the terms of the ordinance.

Electric Railway in Bordeaux.

American manufacturers of electric-railway apparatus are advised by Consul Tourgee that the Tram and Omnibus company of Bordeaux, France, a company having the exclusive right to operate street cars and omnibuses in that city, has recently sold out to a new company, which will operate under a new charter. It is understood that the old company is to receive 12,000,000 francs ($2,316,000) for its property and rights for the unexpired term of its charter. The former company was English, with headquarters in London; the new one is French. The chairman of the board of directors is M. Mercet, 10 rue de Londres, Paris. It is understood that the service will be extended and that the new company will at once proceed to substitute electric power for animal power, which has been used heretofore. Information can be obtained by addressing M. Bretherton, managing director, Tram and Omnibus company, rue Tivoli, Bordeaux, France.

Ohio Electric Light Association.

The fifth annual meeting of the Ohio Electric Light association was held in Cleveland on October 10th and 11th. The programme included the following-named papers: "A Few Suggestions to the Managers of Small Central Stations," by George Hayler, Jr., Van Wert, O.; "The Evolution of the Steam-turbine Dynamo," by Leon Le Pontios, Cleveland; "Street Lighting by Direct and Alternating Currents," by M. E. Turner, Cleveland; "The Arc-lamp Department of Central-station Business" (street lighting), by H. W. Hillman, Schenectady, N. Y.; "A New Compensated Revolving-field Alternator," by H. G. Reist, E. E., Schenectady, N. Y. A lecture, "Demonstration of Liquid Air," by Charles E. Tripler, was announced for Thursday evening.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Mississippi Valley Telephone company explained to the satisfaction of the St. Paul Board of Assembly that its tearing up a certain street before the permission had been granted by that body was through error rather than intention. The company has 1,100 instruments placed, 10,000 feet of 100-line cable put in conduits, a $16,000 switchboard making ready for use and is wiring for 300 additional instruments.

The Northwestern Telephone Exchange company has postponed the erection of its new building in Grand Forks, N. D., until spring, owing to inability to get the necessary supplies this fall.

It was reported in Minneapolis that the druggists who allowed the Northwestern Telephone Exchange company to place slot machines in their stores received no bills. As these machines have been operated during the treaty of peace with the druggists, without using the slots, it would indicate that they were favored by free service. The company denies that any have been given free service and says if they have not received the regular bills, it is owing to error and not intention.

The Hutchinson (Minn.) Telephone company has concluded to wait for lower prices on telephone supplies before enlarging its switchboard.

The Chamberlain (S. D.) Telephone company has its metallic-circuit system in working order and it proves a great improvement over the old system.

The Iowa, Dakota and Minnesota Telephone company has been incorporated at Sioux Falls, S. D., by T. A. Potter, S. P. Hesley, B. C. Way of Britt, Ia., and Joseph Kirby and J. E. McMahan of Sioux Falls. Capital stock, $500,000.

G. H. Pennison proposes to establish a local telephone exchange at Elk River, Minn.

Charles Edwards, manager of the Northwestern Telephone Exchange company's office in St. Cloud, Minn., has been promoted to manager of the system of Fargo, N. D., and Moorhead, Minn. He is succeeded by B. B. Mason, late of the Minneapolis office.

C. H. Hudson succeeds D. R. Craig as manager of the Mississippi Valley Telephone company's office in Minneapolis. Mr. Craig has returned to Keokuk, Ia.

The Iowa Telephone company will make improvements and extensions to its system at Davenport, Ia., and the connections with Rock Island and Moline, Ill., to cost $100,000, it is said.

The president of the Mutual Telephone company of Des Moines, Ia., denies the report that the Bell interests will secure that company's system.

The County Telegraph and Telephone company has been organized at Waterloo, Ia., with $150,000 capital stock.

A telephone franchise was voted at Moulton, Ia., and the local company began work at once on the system.

The Iowa Telephone company is building a toll line from Ottumwa, Ia., to Hedrick, Ia.

The Iowa Telephone company has combined its Charles City and Mason City districts into one district, of which Dr. D. Stuart of Mason City will be manager.

Charles M. Dougherty, who has been manager of the Wood County Telephone company at Marshfield, Wis., has resigned to accept the position of lineman for the same company. A. W. Bryant of Merrill, Wis., succeeds him.

The People's Telephone company of New Richmond, Wis., has been sold to Dr. Epley of that city.

Eden Valley, Minn., now has connection with Litchfield, its county seat. Improvements are being made to the local system in Litchfield also.

The Faulkton (S. D.) telephone exchange has been formed to install and operate a local system.

The Bell interests in Eau Claire, Wis., made advance in rates October 1st, somewhat to the disgust of the patrons there. There is some talk of an Independent company, but it does not seem to amount to much. The advance was 25 per cent.

The manager of the Northwestern Telephone Exchange company in Minneapolis, C. P. Wainman, has addressed two epistles to the public. In one he asks the co-operation of his patrons in the use of the identification cards, which are to be presented when it is desired to use a strange telephone. In the second he gives the company's side of the contest with the druggists, and charges that the druggists' wires were crowded with frivolous conversation from "mashers and deadbeats."

The Mutual Telephone company has been granted a franchise in Moulton, Ia.

The E. H. Martin Telephone company of Webster City, Ia., is reported to have made a deal with the Iowa Telephone company, by which a metallic circuit is to be run from Algona, Ia., to Luverne, Ia., and exclusive connection made with the Western Electric, which will soon have a metallic circuit south to Luverne.

The Home Telephone company has been formed by local investors at Ida Grove, Ia., and will proceed to install an exchange. C. H. Smith of Odebolt, Ia., has been about to put one in, but it is expected arrangements will be made to purchase the materials he has on hand for use in the new exchange.

The Billings and Musselshell telephone line is now complete between those cities in Montana. It is 80 miles long.

Blagovestchensk Boasts of Its Telephones.

In the course of his travels in Siberia a Chicago Record correspondent tarried at Blagovestchensk, which he describes as a lively and typical Siberian city. The telephone service attracted his attention and he thus describes it: "The proudest boast of Blagovestchensk is its telephone system. The telephone wires at Vladivostok and Khabarovk are for military use. The Blagovestchensk line has 230 subscribers, who pay an annual fee of 80 rubles ($40), and are allowed all the switches they want. In the central office are several girls of meek aspect and weary faces, who look as if the Russians were as exacting and impatient in matters telephonic as are Americans. When the Russians ring up central they have to say 'hello' the same as the American, and when we heard their calls we felt partially consoled for our tedious task of memorizing Russian words. The telephones were marked 'Ericsson, Stockholm,' and the boxes were pretty specimens of inlaid woodwork."

Litigation in Rochester.

In Rochester John A. Barhite, plaintiff in the action brought against the Home Telephone company of that city, has filed exceptions to the decision of Justice Dunwell. These exceptions are taken to the conclusions of law. The appeal is taken from Justice Dunwell's decision or judgment in sustaining the Home company's demurrer to Mr. Barhite's complaint. The purpose of the action is to set aside the franchise granted by the Common Council to the Home company and to enjoin it permanently from using the franchise. As no temporary injunction was obtained, the Home company has the right to proceed with its plans. Both parties will have to wait for the next term of the Appellate Court before the argument is heard.

COMMUNICATIONS.

Good News from Duluth.

To the Editor of the Western Electrician:

Presuming that your readers would like to be apprised of the state of the Independent telephone movement in this part of the country, I may state that the Zenith City Telephone company has sold $145,000 of its capital stock of $200,000, largely to Duluth business men, and that amount has all been paid in. All the stock we want to offer now is $15,000 more, which will complete our system of 1,000 telephones and without one dollar of indebtedness—all copper-wire, metallic circuits with multiple switchboard and long-distance telephones. We expect to be in operation with 1,000 telephones in December. We have that many contracts now, and 500 in Superior, where we expect to be in operation at that time. We will set several hundred men to work next week wiring buildings, etc. On both sides of the bay our contracts for telephones are all on five years' time. The people are all enthusiastically for the new companies, and demonstrate it by their co-operation.

R. H. EVANS.

Duluth, October 2, 1899.

Effect of Cold on Telephone Wires.

To the Editor of the Western Electrician:

Thinking it may be of interest to the readers of your journal, I will describe a queer case of trouble we have just experienced. The line in question is an iron-metallic one, 20 miles long, with eight stations cut in, part being farmers' residences. Nearly every evening at about nine o'clock the line would go "short" as far as signaling was concerned, and in the morning between seven and nine the trouble would clear up. As the line was a bridged one, using coils with 100-ohm secondaries, the natural conclusion was that some person became tired of his bell ringing at night and left his receiver off. All users denied this charge, however, and we were at considerable trouble in locating the difficulty, and would have been still longer in the dark were it not for the recent cold snap.

In cutting in the ordinary transpositions the upper cross-connecting wire had been left arcing up, with a height of about two inches, and in "cinching" it on, the line had been given a twist so that when the cold of the night tightened the line, the spring of the wire would cause the arc to reverse, thus crossing with the lower wire. When the line expanded to a certain point, the arc would again reverse, thus clearing the line.

F. N. AVERILL.

Traverse City, Mich., October 2, 1899.

Chicago Telephone Company.

It is said that the Chicago Telephone company will spend a million dollars within the next year in extending and improving its system. The company now has three large downtown exchanges—Main, Central and Harrison. The main building at Washington and Franklin streets has been more than doubled in capacity this year, and a branch-exchange building on the West Side, known as "Monroe," on Sangamon street, near Madison, is nearing completion. In addition contracts have been let for the erection of five other buildings, of a uniform type, for branch exchanges. These will be named and located as follows: North, 271-75 Chicago avenue; Lake View, 1197-99 Sheffield avenue; West, 22 Seeley avenue; Yards, 4122-26 Union avenue; Wentworth, 6308-10 Stewart avenue. The underground and other construction work needed for the centering of the wires in these new buildings has been substantially completed, and the work in hand forms part of the general plan of the company in view during the process of reconstruction, which was to provide for the operation of 50,000 telephones in Chicago. The buildings are to be completed and the new apparatus installed early next year, and the lines in the various districts will be transferred to them at that time. Orders were placed and arrangements made for the various pieces of real estate originally with the expectation of opening the offices this fall, but the Western Electric company, on account of the unprecedented amount of telephone apparatus now being made, was unable to complete the switchboards.

Competition in Niagara Falls.

The new Independent telephone company recently organized for Niagara Falls is giving the Bell company a big push for business. The home company has all its poles ready for erection, and it will have its exchange in the Arcade building. Niagara Falls people have become thoroughly disgusted with the Bell methods and high prices, and they welcome the new company, its enterprise, moderate rates and improved service promised, with open arms. The Bell people have commenced advertising in the local papers for business—a thing they were never before known to do. They also promise better service and cheaper rates, but the old patrons of the company are still paying old prices, which are far beyond what they should be. In Niagara Falls the Independent telephone movement, apparently, has an exceedingly bright future. Major A. G. H. Hardwicke is one of the local men who seek to free the people from monopoly's grasp.

SUBSCRIBERS AND RATES.

Baltimore subscribers of the Chesapeake and Potomac Telephone company complain bitterly of wretched service. It is said that subscribers have been known to ring their telephone bells even 10 minutes without receiving an answer.

Mrs. Mary A. Slocum of Indianapolis has brought suit for $150 damages against the Central Union Telephone company. She says the operators refuse to answer her calls. The manager of the exchange claims it must have been due to trouble on the lines, as the operators could not discriminate even if they wished to.

A dispatch from Chippewa Falls, Wis., states that that city is now practically without telephone service. As the result of a raise in rates by the Wisconsin Bell Telephone company a concerted movement was inaugurated among business men, all agreeing to order the telephones out. The business men say a new system will be built.

EXTENSIONS AND IMPROVEMENTS.

The new central exchange of the New York and New Jersey Telephone company in South Orange is completed. The wires in the township have been put under ground and connected with the central station.

Plans for the five-story, fireproof, steel structure to be erected by the Maryland Telephone and Telegraph company at a cost of $125,000 have been completed. An improved switchboard with a capacity for 6,000 telephones and costing $150,000 will be installed. The new plans also include the erection of six supplementary exchanges in different parts of the city, each with a capacity of about 1,000 telephones.

MANUFACTURERS AND DEALERS.

The Standard Telephone and Electric company of Madison, Wis., is doing an extensive business. A local writer says: "I have watched these works very many times since they started up, but a great surprise met me a few days ago when going through with officials Batchelder, Nate and Quinn. Talk of business! Well, I hadn't seen such hustling for a long season. They are finishing up and packing goods for Honolulu! They had sent box after box to various points in the East Indies; in fact, the shipping books show that goods manufactured in this house go to all parts of the civilized world."

Electric Vehicles for the Army.

For the first time in the history of the United States a contract has been placed and executed for electric automobiles, three in number, designed for the Signal Corps of the United States Army, expressly under the specifications of the chief signal officer.

Two wagons are made like that shown in Fig. 1 and are designed to carry the Signal Corps' various instruments and paraphernalia, and one wagon (Fig. 2) is designed for the officers of the Signal Corps to ride in.

The equipment of the first-mentioned wagons includes 40 cells of storage battery of sufficient capacity, it is said, to run the vehicles 30 miles on one charge of the batteries when carrying 1,500 pounds of transportation load. The motor equipment consists of two 3½ horse power motors, one attached directly and independently to each rear wheel. They are so wound and designed that they can be worked on grades and bad roads as high as six horse power each, which would mean a maximum horse-power capacity of 12 horse power for each wagon, the batteries being of sufficient size to work at that point for temporary work.

FIG. 1. ELECTRIC VEHICLES FOR THE ARMY —SIGNAL-CORPS WAGON.

The maximum speed of the vehicle is 10 miles an hour. A notable feature is the entire absence of anything like bicycle construction. Every piece of ironwork in the vehicle, from start to finish, was hand-forged. The wheels were especially designed and made with steel hubs, the inside of which form receptacles for the ball bearings, as it was found that iron hubs were not adequate to this work. Solid hard-rubber tires, 2½ inches in diameter, have been used.

While similar in appearance to delivery wagons, the interior arrangement is constructed after army specifications. The space is accessible from both rear and front, and doors are supplied, which, when the wagons are not in use, lock everything securely in their interior.

These army wagons are finished in olive green in both body and gear, without any form of ornament or striping, being painted as near the color of grass and foliage as possible, so that they will not be conspicuous to the enemy in the field. They are fitted up with electric lights in the side lanterns, and, in the larger vehicles, in the interior also, and it is understood that later a new form of searchlight will be added to the equipment, for use as occasion may require.

The wagons were turned out complete from the shops of the Woods Motor Vehicle company of Chicago, which was awarded the contract by the government.

Chicago Street-railway Valuations.

The figures on personal-property valuations of some of the street-railway companies of Chicago, as made by the assessors and revised by the Board of Review for the current year, are as follows:

Chicago City Railway company	$5,000,000
West Chicago Street Railroad company	3,992,500
North Chicago Street Railroad company	3,297,500
Chicago Consolidated Traction company	421,000
North Chicago Electric Transit company	175,000
North Chicago Electric Railway company	45,000
Chicago and North Shore Street Railway company	35,000
Chicago and Jefferson Urban Traction company	75,000
Ogden Street Railway company	30,000

These figures do not include real-estate valuations.

The council of Wausau, Wis., is considering the establishment of a municipal electric-lighting plant. The estimated cost is $22,000.

Exhibits at the Export Exposition.

In some respects the showing of electrical machinery and appliances that occupies so large a part of the southern wing of the main exhibition building at the Philadelphia Export Exposition is unique. Most of the manufacturers have designed their exhibits especially to catch the eye of foreign buyers, who are expected to be present in large numbers during the month of October. Consequently, the electrical display takes on the general character of the exhibition and differs from what would be seen in a purely domestic exhibition. Each particular market has its peculiarities, and those manufacturers who meet these naturally have an advantage over those who do not. One of the purposes of the exposition is to teach the manufacturer the art of international trading; to show him what goods are in demand in certain countries where he desires to put his productions on sale, and to show him how goods must be packed, marked and shipped to meet the requirements of the different markets.

That the electrical industry is alive to the importance of the vast markets for American electrical machinery and appliances that are presented by the nations of the world is attested by the cordial indorsement and co-operation given the exposition by the electrical fraternity.

FIG. 2. ELECTRIC VEHICLES FOR THE ARMY.—TRAP FOR OFFICERS.

Occupying a commanding position in the south pavilion of the main building is the exhibit of the John A. Roebling's Sons company of New York. A full line of iron, steel and copper wire, wire rope and insulated wire of every description is shown. Mr. U. G. Tingley is in charge.

A large number of colored electric lights mark the exhibit of the General Electric company, the booth being completely studded with them, while four large signs, at the top of the stand, carry the company's name in red electric lights. The exhibits consist of a constant-current transformer, an "M P 4-15-400" generator to run motors, fans, etc., small instruments and a new type of alternating-series arc lamp. A sewing machine run by a small electric motor attracts the attention of the ladies to the General Electric booth. The exhibit was installed by J. J. Lowthlan, who will continue in charge throughout the period of the exposition.

The Joseph Dixon Crucible company, whose graphite products are so extensively used in the electrical industry, has a fine exhibit of graphite in its crude and manufactured state.

A very poular exhibit, and one that is attracting much attention among the foreign visitors, is that of the International Correspondence Schools of Scranton, Pa. H. D. Judd is on hand and gives a lucid description of the methods of the school in teaching electrical engineering, telephony and telegraphy.

Partrick, Carter & Wilkins of Philadelphia, manufacturers of electrical house goods, have a very complete exhibit of annunciators, household electrical fittings, supplies, etc., that will undoubtedly appeal to prospective purchasers from abroad. The firm's patent needle annunciator, which is extensively used throughout this country and the British provinces, combines a notable simplicity of construction with a uniformly perfect performance. The firm's circular traces the history of lightning in the following words: "1752—Called down from the clouds by Dr. Benjamin Franklin. 1844—Captured, sent to school and taught to read and write by Professor Samuel F. B. Morse. 1899—Thoroughly trained in the perfect performance of manifold household duties by Partrick, Carter & Wilkins."

The exhibit of the Cutter company of Philadelphia is an impressive one. It consists of a great variety of I-T-E circuit-breakers, covering almost every type of machine that is in use to-day. This concern makes a specialty of alternating-current circuit-breakers for high-potential work.

Adjoining the Cutter stand is the exhibit of the Jandus Electric company of Cleveland, O., comprising 42 Jandus enclosed arc lamps. This type of lamp represents one of the greatest advances that has been made in the art of lighting since the introduction of the commercial arc. A fluent talker explains the lamp to everyone who wishes to see how it works.

The exhibit of the Standard Underground Cable company of Pittsburg is contained in four hardwood cases, and comprises wires and cables for electrical uses, including street-railway, telephone, electric-light and power, and telegraph and fire-alarm purposes. The assortment of wire is large and attracts favorable attention.

One of the exhibits which is quick to catch the eye is that of the Wagner Electric Manufacturing company of St. Louis. It consists of a handsome marble switchboard and several transformers for lighting, power transmission and motor work. These are operated every day and prove of much interest to visiting electricians.

One of the most prominent and interesting exhibits in the south pavilion of the main building is that of the Otto Gas Engine Works of Philadelphia. Besides having in operation two 60 horse power engines, one of the regular commercial type furnishing power for the exposition, this concern is also showing a special engine, driving a generator for lights, motors, etc.; also a 15 horse power gas engine, driving a small dynamo, for lighting the exhibit.

The Helios Electric company of Philadelphia has a comprehensive exhibit of the well-known

Helios arc lights, as well as those of the Helios-Upton alternating constant-current type. George E. Breet is in charge of the exhibit.

In the Transportation building the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing company have placed a notable exhibit, in the shape of an electric shifting locomotive. This locomotive weighs 25 tons and is a double-ender, with two headlights. It is equipped with two Westinghouse motors, each of 50 horse power, geared one to each axle. It has a drawbar power of 8,000 pounds, and can haul about 20 loaded cars on a level road. It takes its current from a wire by means of two trolleys, so as to guard against breaking the current by the trolley jumping from the wire. The wheels are 33 inches in diameter and the wheel base is 16 feet. The Baldwin company has built 75 electric locomotives within the last 18 months, 11 of them being, like the one exhibited, for switching purposes, and the others for use in mining operations. Some of these were for Japan, Hawaii and elsewhere abroad, while the government has three of them in use at the Indian Head proving grounds.

Electric motors for operating various exhibits are the vogue at the exposition. Among the uses to which they are put are the operation of a cider press, a sewing machine, a cash register, while one concern uses a motor in an alkali demonstration.

The exhibit of Queen & Co. of Philadelphia is made prominent in the evening by some startling effects with Geissler tubes. The name of the firm is flashed in brilliant apple-green light in script letters from its showcase, and a combination of tubes, of various colors and forms, frames the exhibit displayed on the wall. The high voltage is produced by a 15-inch spark induction coil. Queen's self-regulating X-ray tubes are shown in several sizes.

The showing of automobiles at the National Export Exposition is rather small, consisting of four different makes of vehicles, two propelled by electricity and two by steam.

The General Electric Automobile company of Philadelphia has a representative showing of vehicles, consisting of a delivery wagon, a truck, a brougham and a runabout. These various vehicles are operated by means of a storage battery, the charge lasting for a run of about 40 miles, it is said.

Roach & Barnes, Philadelphia agents for the Waverley Bicycle company, have a sample automobile, made by this concern, on exhibition. It is also of the storage-battery type, the battery being located in the rear of the body of the vehicle and enclosed in a substantial and compact compartment. The battery has to be recharged every 40 miles of travel.

The Locomobile company of America shows the Stanley steam wagon, several different types being exhibited. The propelling power is steam, generated from gasoline.

The Oakman Vehicle company exhibits a vehicle equipped with a Hertel motor, steam being the propelling power.

Telegraph Line to Dawson City.

The Dominion government Telegraph Department of Canada announces the completion of the telegraph line from Skaguay, Alaska, to Dawson City, Northwest Territory, and that messages can now be accepted beyond Seattle, Wash., at the following rates:

	Ten Words.	Each Additional Word.
Skaguay, Alaska	$0 35	
Bennett, N. W. T.	1 35	5 cents
Cariboo Crossing, N. W. T.	1 85	10 cents
Tagish, N. W. T.	1 95	10 cents
Miles Canyon, N. W. T.	2 10	10 cents
White Horse, N. W. T.	2 10	10 cents
Lower Labarge, N. W. T.	2 35	15 cents
Hootelinqua, N. W. T.	2 60	15 cents
Five Finger, N. W. T.	3 35	20 cents
Fort Selkirk, N. W. T.	3 85	20 cents
Dawson City, N. W. T.	4 35	20 cents

The company further announces a press rate between Skaguay and Bennett of one cent a word, with the minimum charge of 75 cents, together with an additional charge of 35 cents a message for the steamer carriage between Seattle and Skaguay.

The line is a little over 600 miles in length and, with the exception of 41 miles from Skaguay to Lake Bennett, constructed by the White Pass Railroad company, was built entirely by the Dominion government. With the opening of the Skaguay-Dawson line there still remains a gap of 1,000 miles between Alaska and the Puget Sound country. This is at present covered by steamships in from three to five days.

Barton—Rust.

Mr. Enos M. Barton, president of the Western Electric company of Chicago, and Miss Mary Rust, daughter of Major Henry A. Rust, chancellor of the University of Chicago, were married in London, England, on October 6th. Mr. Barton is one of the leading business men of Chicago, having been connected with the Western Electric company, which has been very successful, since its organization. His first wife died some time ago, leaving him with three children. Mr. and Mrs. Barton will, it is believed, spend the winter in foreign travel.

COMMUNICATION.

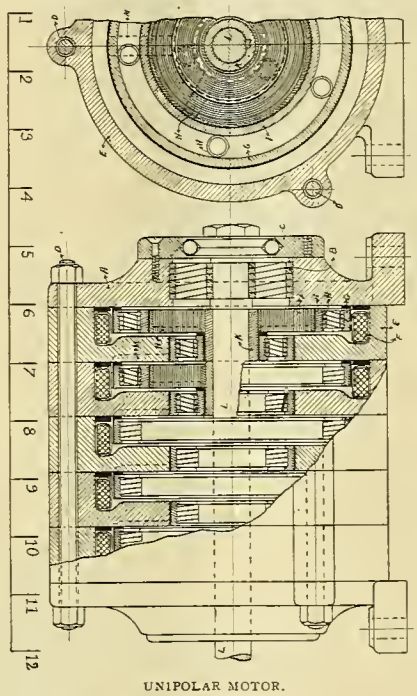
Unipolar Motor.

To the Editor of the Western Electrician:

In a recent editorial in the Electrical World and Engineer (September 9th) entitled "Wasted Effort," there are a number of statements to which I would like to take exception.

The first impression made by this editorial is that the writer takes an exceedingly pessimistic view of the possibilities of progress; it appears, indeed, as if he would exclaim, "We have now arrived at the top notch of perfection; it is useless to try to go any farther." This is, of course, true for a few articles of commerce, such, for instance, as candles, which have been gradually and slowly perfected from the original tallow-dip to the paraffin or stearin candle of our day. The stearin candle is no doubt perfect—as a candle; but what about the electric light? The best illuminant of present development is not a candle; it is something essentially different. In the same way, to extend the analogy, it is very probable that the perfect dynamo or motor of the future will not resemble our present types any more than the electric light resembles the candle.

The criticism of the article is directed against the proposed unipolar dynamo of Mr. James Asher. Mr. Asher assumes that if a straight cylindrical bar magnet be turned around its geometrical axis, the "lines of force" will also turn; whereas, actually, the "lines of force" will remain stationary in space. This misconception is probably founded on the idea of "lines of force" as something tangible or existing, instead of a mere mathematical expression of electromagnetic ether stresses.



UNIPOLAR MOTOR.

In criticizing the wasted effort of various inventors, the editorial writer gives an example that destroys his own argument. He cites the case of the rotary engine as a parallel to the unipolar dynamo, in face of the fact that engines of the rotary (or turbine) type have come to stay, and will ultimately displace all other types. The fact that many failed where a few succeeded does not prove that the efforts of the many were wasted. On the contrary, we must consider these failures as necessary factors in the success, built and founded upon them.

The editorial critic takes the position that, as the present type of dynamos has already attained such a degree of efficiency that the remaining margin of improvement is of no value commercially, any attempt to improve it in other respects must be a waste of effort. He states that he is "not aware that any claim has been made that a unipolar dynamo could be constructed more cheaply than one of corresponding capacity of another type, or that it would be cheaper to operate." Such a claim I now wish to put forth. I will briefly describe a "continuous-pole" motor of my construction, which I consider cheaper to build than the present type, lighter and equally as efficient. I constructed it with special reference to direct connection to machine tools.

The proposed motor will be built in sections, each section taking about 22 volts, and as each section can be treated practically as an independent motor, this feature makes it suitable for automobiles, where the storage batteries generally are arranged to give 22, 44 and 88 volts. It can also be arranged for any voltage, simply by adding sections.

Referring to the drawing, (A) represents the end plates, which carry the spring roller bearings (B). Any other form of bearing can, of course, be used, but will not be so nearly frictionless. (C) is an adjusting bearing, for the purpose of accurately centering the armature in the field. The end plates and sections are held together by bolts (D). The field is formed of the iron rings (E) and the coils (F), which are perfectly circular and wound so that the lines of force will have the same direction through all. Contact is established between (G) and (I), by means of small spirals (H) of phosphor-bronze. (J) is the laminated armature, made up of a band of annealed iron wound in spiral on the sleeve (K), and with a steel ring shrunk on outside. (L) is the shaft on which is a pinion or pulley (not shown) for transmitting the power. (M) is the stationary winding going from periphery to center, and (N) the movable winding going from center to periphery. By the reaction between these windings and the magnetic field the motor is operated. The motor is intended to run at a comparatively high speed—about 4,000 revolutions per minute for the three-fourths horse power size shown. [Actual size is shown by the accompanying scale in inches.]

The claims I would make for a motor of this kind are: First—Its low cost of manufacture. It consists of very few and simple parts, repeated a great number of times, and it will weigh about one-quarter as much as the present type, while the cost per pound would be about the same. Further, it has cast windings and straight cylindrical exciting coils, which do not require any skill in winding. Second—Its lightness and small space are due partly to the high speed and partly to the compact design of the magnetic circuit. Third—It is possible to vary the speed within wide limits without wasteful resistances, simply by coupling the elements like so many galvanic batteries, at 25 volts each. Fourth—It can be made to run economically on very low speeds and, at the same time, by a different coupling of elements, be capable of enormous overloads at increased speed.

The principle on which this motor works is the same as that of Faraday, and the principal innovation is in the use of cast windings and a laminated armature, together with the current collector, which maintains the contact by a rolling phosphor-bronze spring.

M. J. EICHHORN.

Chicago, October 6, 1899.

Electrical Machinery for St. Louis.

From the works of the Westinghouse company another large generator has been shipped to the Missouri-Edison Electric company, St. Louis, Mo. This generator has a capacity of 500 horse power, alternating current, in two-phases of 1,100 volts each, at 7,200 alternations per minute. Westinghouse machinery is well known in St. Louis, as that city was a pioneer in using alternating current, and Westinghouse generators have been in constant use there since 1889. The power station of the Missouri company contains 16 Westinghouse generators, aggregating over 10,000 horse power, three of them being 2,000 horse power each. These large machines are 14 feet high, the revolving armatures measuring 10 feet in diameter, with a weight of 80,000 pounds. These armatures act as flywheels to their engines, being built upon the engine shafts. The Missouri company possesses one of the largest electric-lighting plants in the country. There are in St. Louis a large number of users of electric power for commercial purposes, such as for elevator service, pumping, driving ventilating fans, and for the mechanical arts. As the demand for electric current is said to exceed the supply, further machinery is secured from the Pittsburg manufacturers.

Chicago Electrical Association.

For the fall and winter season the Chicago Electrical association has arranged the following programme of papers:

October 6, 1899, "Underground Conduits for Electrical Conductors," C. H. Sewall, John A. Roebling's Sons company; October 20th, "Relay and Multiplex Telephony," H. P. Clansen, American Electric Telephone company; November 3d, "The Development of Constant-current Arc Lighting," H. M. Biebel, Western Electric company; November 17th, "The Design of Fusible Cut-outs," Benjamin H. Glover, Electrical Bureau of the National Board of Fire Underwriters; December 1st, "Alternating-current Arc Lighting," E. P. Warner, Western Electric company; December 15th, "Electric Meters," Edward S. Halsey, Chicago Edison company; January 5, 1900, "Modern Construction of Dynamo-electric Machinery," H. R. King, Western Electric company; January 19th, "The Arnold System of Power-station Construction," Bion J. Arnold.

The meetings are held in rooms 1736-1741 Monadnock block, beginning at 8 p. m.

Wattmeter Patent Litigation.

On September 29th service was made in a suit brought by the Stanley Instrument company against the General Electric company for alleged infringement of the Stanley patent No. 423,210, dated March 11, 1890, on alternating-current wattmeters. The Stanley Instrument company claims that this patent is fundamental and covers broadly induction wattmeters. This suit is brought before the Federal Court in Massachusetts.

Series Arc Lighting from Constant-current Transformers.[1]

By William Lispenard Robb.

In all long-distance transmissions of electricity, and when large areas are supplied from a single advantageously located power plant, we must, at least in the present state of the art, generate and transmit alternating current.

In general, it will be found desirable, in my opinion, to supply current to the street lights from the same secondary mains that supply the current for the commercial lighting and power. There are, however, in most places large districts in which the streets are lighted by arc lamps, and where there is no commercial lighting or power. These sections can be most economically lighted by series arc lights.

Various methods of operating series arc lamps from alternating-current systems have been suggested and are in successful operation.

In several well-known stations in this country continuous-current series arc dynamos are driven by synchronous or induction alternating-current motors, the arc dynamos being either direct-connected to motors or belted from a line shaft which is driven by motors. In England direct-current series arc lamps are operated successfully from rectifiers. In 1896 the Hartford Electric Light company, with which I am associated, decided that it would be advantageous to make a radical change in its system of series arc lighting, with a view to obtaining a greater economy of operation. The series commercial arc lamps and the street lamps in the same section of the city were changed over from series open-air arc to constant-potential arcs. It was considered advisable to continue the series arc lamps for lighting the outlying portions of the city. Propositions were considered both for using motor-driven series arc dynamos and for using rectifiers.

An order was finally placed with a manufacturer for a rectifier. A satisfactory rectifier never materialized, and we were unsuccessful in our attempts to import one from Europe.

The development of the enclosed-arc lamp quickly led to the evolution of a satisfactory alternating-current arc lamp of the constant-potential variety. The perfection of this lamp led Mr. Richard Fleming, one of the engineers of the manufacturing company, to suggest the advisability of operating series alternating-arc lamps from the constant-current transformer, which formed one of the essential parts of the rectifier.

An experimental transformer having a capacity for operating 30 lights in series was installed in April, 1898. After being subjected to a thorough test in the central station, it was put in practical operation on a street circuit. The results of these tests were so satisfactory that an order was soon placed for several transformers, each having a 100-light capacity. The first of these transformers was installed about a year ago, and during the year all of the continuous-current series arc dynamos have been replaced by constant-current transformers.

It has seemed to me that it would be of value to some of the members of the Institute if the data obtained in the operation of these transformers was made a matter of record in the proceedings.

The Constant-current Transformer.

Each transformer is enclosed in a cylindrical tank. The tanks were originally made of boiler iron, riveted up, but it proved impossible to keep these tight against the transil oil in which the transformer is immersed. The tanks are now made of cast-iron.

The core of the transformer is of the sheet type, with a large central vertical core, rising the whole height of the tank. This central core is surrounded by the primary and secondary coils, and the magnetic circuit is closed by return paths outside the coils. In the transformers, as made by the General Electric company, there are two primary and two secondary coils. One of the primaries is fixed at the bottom and the other at the top of the central core. The two secondaries are free to move up and down between the primary coils and are so connected together that when one falls the other rises. They may approach into contact with each other at the middle of the tank, or from this position one may rise toward the primary coil at the top, while the other falls toward the primary coil at the bottom. Connected with the chains by which they are balanced is a lever, which extends outwardly from the top of the oil tank and carries depending from its outer end a heavy adjustable weight. The lever is supported on a hardened steel knife-edge. This weight tends to force the two secondary coils respectively toward the two primary coils. When the transformer is in operation the currents induced in the secondary react upon those in the primary and tend to force the coils apart. This force is balanced for the desired normal current by the adjustable weight outside of the case. If the resistance of the secondary circuit falls, due to the cutting out of lamps, the current increases slightly, increasing the repulsion effect, and the secondary is pushed further away from the primary, giving a chance for increased magnetic leakage between the primary and the secondary, which reduces the electromotive force in the secondary, bringing the current down to practically normal, even with wide changes of resistance. The regulation obtained is adjustable by means of a cam-shaped segment, which can be moved on the outer end of the weighted lever.

The principle of regulation was first suggested by Professor Elihu Thomson, and its application to the operation of constant-current transformers is broadly patented by him.

By bringing out the proper connections from the secondaries the total number of lights may be operated as a single circuit or operated in any desired number of multi-circuits in a manner similar to the well-known method employed on the Brush series dynamos of large capacity.

The larger sizes of this type of constant-current transformers are always so arranged that the lights can be run on two circuits, or a single circuit, as may be desired. Owing to the high voltage of the enclosed-arc lamp, the 100-light transformers usually operate two circuits connected upon the multi-circuit principle.

The transformer can be adjusted so as to give practically a constant current between one-third load and full load. As the properties of the transformer make it undesirable to run the transformer at less than one-third load, no attempt has been made to so construct the transformer that it would regulate under smaller loads. By adjusting the cam-shaped segment from which the counter-balancing weights are suspended, it is possible to regulate the transformer so that the current will increase or decrease as the number of lights is varied. The curves shown in Fig. 1 show the range of regulation that can be obtained by varying the adjustment of the cam supporting the regulating weights.

The early tests showed that when the transformers were adjusted to give a constant current through any desired range of load, that the lamps would draw different lengths on the arcs, depending on the number of lamps on the circuit. The voltage across the terminals of the individual lamps was approximately 10 volts higher at one-fourth load

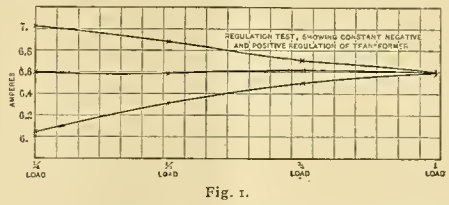


Fig. 1.

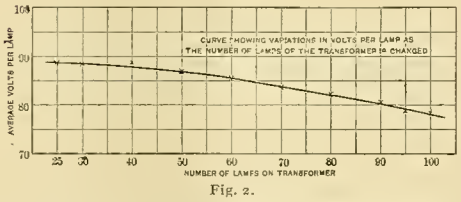


Fig. 2.

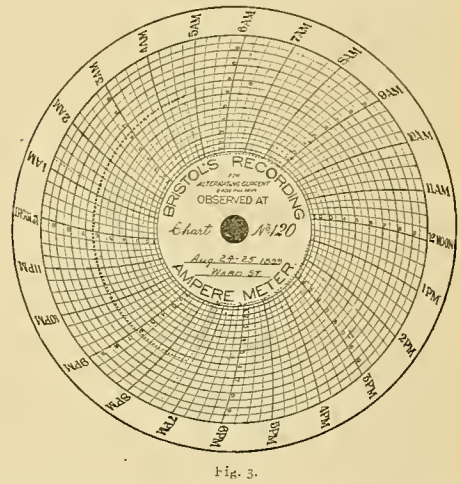


Fig. 3.

SERIES ARC LIGHTING FROM CONSTANT-CURRENT TRANSFORMERS.

than at full load, although the current was the same in both cases. The results of a test of a 100-light transformer, made to show this effect, is shown in Fig. 2. It has been found, however, that by varying the adjustment of the transformer it is possible to adjust it so that the voltage across the terminals of the individual lamps remains practically constant at various loads. If so adjusted, however, the current from the transformer is no longer constant, but increases as the load increases. The adjustment that maintains a constant voltage across the terminals of the individual lamps seems the preferable one in those cases where the load of the transformer varies through a wide range. It is, however, of little practical importance in the operation of a street-lighting circuit, as in that case the transformers are seldom operated in actual practice at less than 90 per cent. of full load.

Tests were made of the efficiency power factor and temperature rise of the transformers. The input and output of the transformers were measured with Weston wattmeters, ammeters and voltmeters and were calibrated before and after test with standard laboratory instruments.

The averages of the results obtained from two 100-light transformers were as follows:

	Efficiency.	Power Factor.
One-fourth Load	88.1	24 per cent.
One-half "	92.3	44 " "
Three-fourths "	94.9	62 " "
Full "	96.1	78 " "

The rise in temperature of the oil of the transformer, measured at the top of the iron core, where it was highest, was 39° C. after a 24-hour run.

Under the usual conditions of street lighting, the dynamos are run under at least 90 per cent. of full load, and at this load the efficiency and power factor are very satisfactory. The power factor is about as high as that of the induction motor under the average load at which they are operated.

The low power factor at fractional loads and the difficulty in maintaining the lamps at constant voltage when the current is constant at various loads combine to make the constant-current transformer undesirable, except when the conditions are such that it is possible to operate the transformer under a large part of its rated full load.

It has been found in practice that the transformers can be maintained and operated successfully with very little attention. In Hartford five of the transformers are operated from two outlying sub-stations. There is no attendant at either of the stations. The inspector of the district cuts on and off the lights at the proper time and visits the sub-stations once during the night. Each transformer is equipped with a recording Bristol ammeter, so that a complete record is made of the time of cutting on and off the circuits, and of the time the inspector makes his nightly inspection, and of the working and adjustment of the transformer. A record selected as being a fair representation of the daily records is given in Fig. 3. The primaries of the transformers are connected across the 2,400-volt alternating-current feeders. Although the voltage at the terminals of the primary of the transformer is subject to a variation of five per cent. during the street-lighting hours, the current supplied to the series-lighting circuits is practically constant. The transformer whose operation is recorded in Fig. 3 takes its current from the alternating-current lighting system, about one mile from the central station. The current in the secondary is not affected by variations in the pressure at which current is supplied to the primary of the transformer.

The Series Alternating Arc Lamp.

The lamps operated from the constant-current transformer are of the carbon-feed enclosed type. The alternating current used has a frequency of 60 cycles. The operation of the lamp is on the differential principle.

The lamps at the outset gave a good deal of trouble. A considerable percentage of the lamps failed to start. This trouble was soon found to be due to the burning out of the sliding contact by which electric connection is made with the upper carbon. A positive contact is now made by means of a very flexible wire, made of fine strands. Since this change the operation of the lamps has been in all respects satisfactory. The records show that the lamps reported out and not starting are considerably less than they were when the street lighting was by direct-current series open-air arc lamps.

Unfortunately, I have been unable, up to the present, to make any photometer tests of the candle power of the series alternating-arc lamps. The lamps used in Hartford consume at the transformer 400 watts per lamp, and replaced nominal 1,200 candle power, open-air, direct-current arcs. The streets are undoubtedly better lighted with series enclosed arc lamps than they were formerly with the open-air arcs. The better diffusion of the light from the enclosed arc lamp, the steadiness of the light and its freedom from flickering, have much to do with the improvement in lighting and with the general satisfaction it undoubtedly gives. From the results obtained at Hartford I am confident the streets can be better lighted with 400-watt series alternating lights than with an equal number of nominal 1,200 open-air, direct-current arcs. If 2,000 candle power, direct-current arcs were replaced by enclosed series alternating it would, in all probability, be necessary to increase the number of lamps in order to obtain equally good lighting.

Before the changes in the street-lighting system the lamps were operated from Excelsior, Thomson-Houston and Brush series dynamos, belted from the line shaft. This was driven by a direct-connected synchronous motor. The power furnished the synchronous motor was 550 watts for each open-air arc lamp consuming 315 watts at the lamp. The power required under the local Hartford conditions for operating street lights has therefore been reduced by the change in the ratio of 550 to 400, or a little over 27 per cent.

Owing to the fact that the transformers are operated from outlying sub-stations, the wiring system has been very much simplified and the cost of carrying current across the underground district considerably reduced. The maintenance of the transformers and the labor in looking after their operation is an almost negligible item. A very considerable saving is made over the maintenance and operation of the series direct-current dynamo. From experience extending now over a year, it

1. Read before the American Institute of Electrical Engineers at New York, September 27, 1899.

has become evident that the saving in operating expenses will pay for the entire cost of the change in system within the first two years. At the expiration of this time there will be a very considerable annual saving, and, at the same time, the service rendered the city is very much better than it was under the old system.

The system of street lighting which will be found best for any given city depends largely upon the local conditions, but there are undoubtedly many cases where an investigation will show that the adoption of the constant-current transformer and the series alternating-current arc lamp offers the greatest advantages.

CORRESPONDENCE.

New York Notes.

New York, October 7.—There has been little or no news of special interest this week except as related to Marconi. It is worthy of note that Marconi's work, now so successful, is said to have been anticipated by others. There seem to be New York papers, rivals of the Herald, which imported Marconi to beat the other newspapers on the news of the race, that are willing to back with long articles the claimants of some of the Marconi thunder. One cannot help wondering why the gentlemen referred to didn't get down to business sooner.

A dispatch to the Herald from London states that the British government has applied to Signor Marconi with a view of employing his system of wireless telegraphy in the Transvaal campaign. Signor Marconi, in an interview, said last night that he had received advices by mail to the effect that the British government had made propositions to the London office for the use of the wireless telegraphic system in South Africa in the event of a war with the Boers, but had received no word of any decision having been reached.

Captain A. H. Mattox, of the Bureau of Publicity to the United States Commission, Paris Exposition, says it is proposed to hold an international congress of those interested in automobiles at the Paris Exposition in 1900. Such a congress, he thinks, would be distinctly valuable to automobile inventors and manufacturers all over the world. It is possible the congress will meet in the Paris Automobile Club, in the Place de la Concorde. Alterations on an extensive scale have been made during the summer, and by the early months of next year the club will have its own private theater.

The New York and Staten Island Electric company made good its promise, mentioned by your correspondent a few weeks ago, and cut out the public lights in the streets of Staten Island, leaving the streets all over the island in darkness. The company took this step in order, if possible, to bring the question of street lighting to an issue and to collect the $180,000 due for services. On the island there are 451 city arc lights and 2,978 city incandescent lights, and the bill for these lights was increasing at the rate of about $8,000 a month. Finally, at the intercession of Congressman Nicholas Muller, the lights were turned on again. It is said that Mr. Muller made himself personally responsible for the payment of the light until a definite arrangement is made between the city authorities and the company.

It is reported that the New York Central Railroad company will replace its present cabs with automobiles just as soon as the new vehicles can be manufactured. Orders for the new vehicles have been placed with the new $10,000,000 Woods Motor Vehicle company, it is said.

The Metropolitan Street Railway company broke its record during the Dewey celebration. The average number of cash-fare passengers carried daily on the lines of the system is about 800,000, and the record day up to last week was June 20, 1899, when 904,000 cash fares were received. On Thursday of last week, however, the number of cash passengers carried was 1,119,000; on Friday, 1,304,380; Saturday, 1,019,440. There were 711,480 five-cent fares paid on Sunday.

The Sixth and Ninth avenue elevated trains carried on Saturday, the last Dewey day, 490,000 passengers. This beats the record on these two lines for a single day. Two hundred and sixty trains, or 1,280 cars an hour, were run on the entire system. During the Columbus celebration in October, 1892, and the dedication of Grant's tomb in April, 1897, respectively, 489,000 and 467,000 passengers were carried by the West Side elevated lines.

The receipts of the Brooklyn Rapid Transit company for the two days of the Dewey celebration amounted to $75,000. They are disappointing, because, while they were expected to eclipse any previous record on the road, they did not equal the receipts of Memorial Day and the day before, and they have been surpassed on several previous occasions.

The power house of the Staten Island Electric company was decorated for Dewey. The men had considerable difficulty in throwing a line over the chimney, which is 125 feet high. Several attempts were made with a bow and arrow. The bow was 12 feet long, and the rope was attached to the end of the arrow. After many trials this method was abandoned, and then a kite was used. It was guided by Superintendent Frederick T. Lewis, and was finally landed over the chimney, but the heat burned it in two. Another attempt was made with the kite, and it was successful. A wire was fastened to the end of a stout rope, and when the kite was in the proper position it was lowered and the wire quickly adjusted and hauled taut. Lights were strung on the wire about a foot apart.

According to the New York World of yesterday, judgment for $820 has been entered against the National Motor Carriage company of No. 1 Madison avenue, in favor of James G. Lynch, for the amount paid on two carriages which were not delivered. The sheriff levied on the office furniture. This company was incorporated under New Jersey laws on August 25, 1898, with a capital stock of $500,000. M. L. G.

PERSONAL.

Dr. A. E. Kennelly of Philadelphia, president of the American Institute of Electrical Engineers, will visit Purdue University, at Lafayette, Ind., during the coming week and will on the evening of the 16th instant deliver a lecture before the School of Electrical Engineering on "Ocean Telegraphy."

Among the prominent visitors to Niagara Falls last week was the Hon. A. P. Greeley, assistant United States commissioner of patents. He inspected the power development with much interest, and also looked over the plants of the Pittsburg Reduction company and the Carborundum company.

Mr. George W. Patterson of Chicago, western agent for Circular Loom conduits and Gordon batteries, celebrated the Fall Festival most sensibly by getting married. The ceremony was performed on October 7th, at the home of the bride, Miss Lily E. Miller. Mrs. Patterson is a Chicago girl, and Mr. Patterson's friends and acquaintances among the electrical fraternity will unite in extending hearty congratulations to him.

ELECTRIC LIGHTING.

The Electric Light and Manufacturing company of English, Ind., which recently made an assignment, has settled with its creditors by paying 50 cents on the dollar, and the matter has been dismissed from the courts.

The Wenona (Ill.) Light and Power company, capitalized at $10,000, has been incorporated to manufacture steam heat and power and electric light and power. Charles Robinson, Charles Fosbender and J. K. Fosbender are the incorporators.

The City Electric Lighting company of Vincennes, Ind., has executed a trust deed and mortgage to the Northern Trust company of Chicago, covering the real estate and plant, to secure a loan of $98,000. The central-station company's claims against the city of Vincennes for public lighting are also covered by the mortgage.

The Delaware Trust company recently filed a certificate of incorporation of the Rio Plata Electric company, capital, $100,000, for electric lighting Porto Rico, the principal office being in the Delaware Trust company's building, Wilmington. The incorporators are Spencer Crosby and Philip T. Penrose, Philadelphia, and Ramon Valdes Bayamon, Porto Rico.

Articles of incorporation of the Philadelphia Electric company, with an authorized capital of $25,000,000, were filed at Trenton on October 6th. The company is authorized to manufacture and supply gas and electricity. The controlling factors in the new concern are P. A. B. Widener, William L. Elkins, Thomas Dolan, William F. Harrity and Joseph McCall.

All indications point to a lively rate war between Montreal's two big electric companies. On September 14th the Royal Electric company announced that it would cut the existing electric rate by 33 1-3 per cent., and now the Lachine Rapids Hydraulic and Land company announces that it will make the sweeping reduction of 40 per cent. per ampere-hour, or 6 2-3 per cent. lower than the rate announced by the Royal Electric company.

A dispute between the village of Maywood, Ill., and J. A. Stephens, who is under contract to furnish light for the streets, may result in a withdrawal of the existing agreement and the forming of a new electric-light company. It is said that Mr. Stephens refused to place incandescent lights ordered by the village trustees. The latter instructed the clerk to send notice to Mr. Stephens to place the lights within 30 days. If he does not do so they may grant a franchise to a new company.

At the celebration of the Mexican Independence Day, on September 15th last, electrical decorations on the national palace and cathedral in the City of Mexico formed a conspicuous feature of the festivities. Says Modern Mexico: "The entire front of the cathedral was magnificently illuminated. From the crosses on the tops of the lofty twin towers down to the foundations, the façade was almost solidly studded with electric lights in the national colors. Over the entrance the national standard of eagle, snake and cactus was formed in electric lights."

ELECTRIC RAILWAYS.

Fire recently destroyed one of the roundhouses of the Birmingham (Ala.) Railway and Electric company. Several dummy engines, motor cars and coaches were consumed. The loss was said to be $60,000.

The Winner Electric Railway company is making a survey between Lawrence and Topeka, Kan., for an electric railway, which is to connect Topeka, Lawrence, Kansas City, Leavenworth and Atchison. It has purchased the old Lawrence and Carbondale railroad and expects to use part of the road for electrical operation.

A 20-year franchise has been granted to the Chicago and Joliet Rapid Transit company, to build an electric double-track line between Lockport and Lemont, Ill. By securing this franchise, right-of-way is now held for an electric line direct from Joliet to Chicago, and it is said this road will be in operation within two years.

During a severe thunderstorm recently a trolley car on the Shelton (Conn.) street railway was struck by lightning. There were 30 passengers on the car and they all received shocks, one lady being fatally injured. It was on this line that the accident of August 6th occurred, when 30 people lost their lives by a car running off a bridge.

The New Albany Electric Street Railway company has been incorporated with a capital stock of $50,000, to construct an electric railway at New Albany, Ind. The incorporators are: W. T. Grant of Louisville; J. F. Gebhardt, W. A. Hedden, H. E. Jewett, John Hieb, R. W. Morris, J. H. Faucett and Earl S. Gwin of New Albany.

It is proposed that the City Council of Chicago establish the office of municipal street-railway expert. The incumbent is to be appointed by the mayor and receive a salary of $5,000. If the proposed ordinance becomes a law, the new officer will advise the city authorities in the various street-railway problems constantly arising in Chicago.

An electric line from Murray to Bingham, Utah, is said to be a probability of the near future. It is projected to connect with the electric systems of Salt Lake. Only 14 miles have to be built to make an all-rail connection via Murray. Articles of incorporation have been filed of the Valley Railway company of Utah, which proposes to build the road. The capital of the company is $200,000. James Campbell is president and Edmund Wilkes is vice-president. Power will be derived from the plant of the Telluride Power Transmission company in Provo Canyon.

It is announced that the electric railway proposed between Greenfield and Indianapolis, Ind., is now a certainty and that construction work will be begun this month. An interesting feature of the equipment of each of the cars to be operated on the line will be a telephone. At switches the conductors will be able to connect their instruments and get in communication with the company's headquarters. They will thus receive their running orders. It is also announced that a farmer who wants anything may notify a conductor, who will telephone the order to the office, and employes of the company will fill it, place it on the cars and ship it to him.

The Massachusetts Street Railway association held its annual meeting on September 14th and elected officers for the ensuing year as follows: President, John R. Graham, Quincy, Mass.; first vice-president, Edwin C. Foster, Lynn, Mass.; second vice-president, Hon. E. P. Shaw, Newburyport, Mass.; treasurer, F. H. Smith, Quincy, Mass.; secretary, Charles S. Clark, Boston, Mass.; executive committee, the president and vice-presidents, P. F. Sullivan, Lowell, Mass.; R. S. Goff, Fall River, Mass.; F. H. Dewey, Worcester, Mass.; H. H. Crapo, New Bedford, Mass.; William S. Loomis, Holyoke, Mass.; auditing committee, J. N. Akarman, Worcester, Mass.; P. I. Saltonstall, Boston, Mass.; George W. Cook, Springfield, Mass.

The Buffalo and Erie Electric Railroad company has been incorporated in New York state, with a capital of $1,000,000, to construct a street surface electric road, 70 miles long, between Buffalo and Erie, Pa.. The directors are C. V. Boughton, A. Schmidt, Jr., Thomas Frenyear, Paul Werner, A. Schmidt, Sr., F. J. Weber, H. P. Queal of Buffalo and W. W. Cole of Elmira. The same directors have also formed the Dunkirk and Kickoryhurst electric railroad, with a capital of $50,000, to construct a road seven miles long through Dunkirk to Point Gratiot, Chautauqua County, and the Fredonia and Lily Dale electric railroad, with a capital of $150,000, to construct a road seven miles long between Fredonia and the assembly grounds at Lily Dale.

AUTOMOBILES.

After a futile attempt by rail, it is said that a young couple of Berlin, Germany, successfully eloped in a borrowed automobile.

The motor gun carriage constructed to the order of Major R. P. Davidson of the Northwestern Military Academy, at Highland Park, Ill., was recently tested in Chicago.

The 50-mile automobile race between the carriages of Dr. E. V. D. Morris of Galesburg and F. B. Snow of Wyoming, Ill., on October 4th, at the Galesburg race track, resulted in the $2,000 wagered being awarded to Dr. Morris. But 15 miles

was covered, as the carriage of Mr. Snow broke down, and, according to the terms of the wager, he had to forfeit the race.

M. Mougeot, director of the post and telegraph service of Paris, is experimenting with automobiles, with the object of facilitating the delivery and collection of letters.

Mr. and Mrs. John Davis of New York, who are crossing the United States in an automobile, have reached South Bend, Ind. They hope to reach Denver in the course of time.

Conspicuons in the bicycle parade at the Chicago Fall Festival was a number of illuminated automobiles. These vehicles, beside forming one of the most interesting features of the parade, also aided the bicyclists by clearing a way for the wheelmen through the throngs of people on the streets.

The committee on superintendence and police of the Fairmount Park Commission of Philadelphia has decided to recommend to the commission that automobiles be allowed to enter the park but restricting the horseless vehicles to certain drives. The commission some time ago prohibited the vehicles from entering the park, and the recent action of the committee was the result of much agitation in their favor.

The Automobile company of Hawaii, recently incorporated with a capital stock of $2,000,000, is said to be arranging with the General Electric company for its electrical apparatus. This company proposes to introduce horseless carriages in the Sandwich Islands for both public and private use. It will use the storage-battery system, and each vehicle will be constantly kept in condition to run 25 miles. It is said that the roads of the islands are ideal for automobiles, being smooth and hard.

PUBLICATIONS.

The American Electrician of New York publishes "Diagrams of Electrical Connections," with explanatory text. The diagrams are clear, practical and useful and show the connections of direct and alternating-current dynamos and motors, systems of distribution, motor regulation, polyphase-current connections and the like.

The General Incandescent Arc Light company has recently issued several bulletins and pamphlets, including a price-list of Tailleur underground apparatus, of which it is the exclusive manufacturer. A circular descriptive of the G. I. arc-lamp hanger reel has also been issued by the company. This device is said to have attracted considerable attention. A neat folder summarizes the products of the company, which are reported to cover a surprisingly large range. New bulletins on arc lamps and on switches are announced as in preparation.

POWER TRANSMISSION.

The new Edison General Electric company of Los Angeles, Cal., has chosen the following-named directors: W. R. Staats of Pasadena, J. R. Miller of Los Angeles and W. H. Spurgeon and J. Turner of Santa Ana. Mr. Staats was elected president of the company and G. E. Whidden was retained as manager.

The Cumberland Falls company of Louisville, Ky., has been incorporated for the purpose of developing the Cumberland Falls, in Whitley County, so that the power can be used for electrical purposes. C. W. Banta is president, Louis H. Morgan treasurer, and James C. Allin, secretary of the company, which is capitalized at $9,000.

The power interests at Niagara Falls, as well as all the people interested in the preservation of the beautiful scenery of the Falls of Niagara, will be much interested in what seems to be an effort to have the next Congress take up seriously the question of building a dam in the upper Niagara River, between the Falls and Buffalo, for the purpose of raising the lake levels in order that the big vessels built during recent years may have water enough to float over places where there has always been low water. Despite the fact that this low water at various points has given much trouble in recent years, the builders of lake vessels have gone on from year to year increasing the capacity of the vessels, until now there is not water enough at some points to float them. This being the case, they now seek a remedy, which it is contemplated to secure by building a dam in the Niagara River.

MISCELLANEOUS.

The zinc producers of Rhine province have undertaken to form a combination for the purpose of limiting production and fixing prices, says a correspondent of the Chicago Record. It is understood that they have already begun negotiations, with a view of drawing into the combination the American producers, without whose co-operation, they say, the proposed arrangement would be of little, if any, value.

In Italy, it is said, there has recently been put in service a car to be used with a railway wrecking train, which has been equipped with a complete electric-light plant. Five 1,800 candle power arc lamps and a number of incandescent lamps, with their wiring wound upon a drum, are provided on the car. In case of a wreck the car can be sent with the wrecking train and the lamps can be distributed about the wreck in any desirable manner.

A dispatch from Kingston, Jamaica, states that the American schooner Adele Thackara, which recently arrived at that port from Philadelphia, encountered a phenomenal electric storm en route. The lightning shivered the mainmast, burned the sails and temporarily prostrated the captain and four seamen. The vessel itself also caught fire, but, owing to the terrific volume of rain which was falling at the time, the flames were soon extinguished.

The organization of the Tripler Liquid Air company, with a capitalization of $10,000,000, is said to have been completed. The company is organized for the purpose of acquiring all patent rights, patents and processes for the manufacture and utilization of liquid air for all purposes as developed by Charles E. Tripler. The officers of the company are: President, Charles E. Tripler; vice-president, Frank J. Cannon; secretary, Philip K. Reynolds; treasurer, E. A. Kirkham.

Two new rolling lift bridges are now building over the Chicago River, one at the crossing of the tracks of the Chicago Terminal railroad, leading to the Grand Central station, and the other at the crossing of Taylor street. Each of the bridges will be operated by electric motors, and although provision will be made for an operator on each side of the river, yet the machinery and electrical equipment will be so arranged that both leaves of each bridge may be operated from one side of the channel.

At the meeting of the Michigan Municipal League last month the question of public lighting and the general municipal ownership of public utilities was discussed and resolutions were passed favoring municipal ownership. After reciting the decision of the Supreme Court on the McLeod law, the resolution says: "We favor the submission to the people of this state, at the earliest possible time, the question of an amendment to the constitution which will permit and allow every city to run, own and operate all of its public utilities, and we hereby request the governor and Legislature to prepare and submit such proposed amendments at the first election after the convening of the Legislature."

Some time ago, says a dispatch from Providence, R. I., James Moran obtained a judgment of $1,500 against the Corliss Steam Engine company of Providence for injuries sustained by an electric shock received from a crane in the engine company's works. Mrs. William Houghton also recovered a verdict for $7,000 for the death of her husband, who was killed by electricity while working at the same crane. These judgments have been paid. Now the Corliss company has brought suit against the General Electric company and the Narragansett Electric Lighting company, which it claims should reimburse it. It charges that the motors furnished by the General Electric company were defective and that the current sent in by the electric-light company was "too strong."

London daily papers of recent issue contain a detailed description of the three electric fountains just started at Crystal Palace, Sydenham, London. It would appear from these descriptions that the fountains are drawing great throngs of people to that already popular resort, as, although electric fountains have been known for some time in this country, this is said to be the first attempt of anything of the kind in London. The fountains were designed and erected by Mr. F. E. Darlington, Philadelphia, Pa., and water is supplied to them by two vertical triplex power pumps, built by the Goulds Manufacturing company, Seneca Falls, N. Y. These pumps are operated by electric motors, and the whole outfit is so simple that it is practically controlled by merely touching a button. The installation of these electric fountains represents a first expenditure of about £15,000.

TRADE NEWS.

Trotter's Mona Manufacturing company, manufacturer of the Mona commutator compound, has removed its offices from 65 West Broadway, New York, to more commodious quarters at 320 Broadway, in the same city.

Mathias Klein & Son of Chicago, manufacturers of linemen's tools and ironwork for line construction, are sharing in the general prosperity. They report a fine fall business.

The superintendent of the Haskell Indian Institute at Lawrence, Kan., is inviting sealed proposals, without date, for furnishing and delivering at the school, as may be required, a large quantity of electric supplies, a full list and description of which may be obtained from H. B. Peairs, superintendent, Lawrence, Kan.

Philip Spies and John M. Klein have organized the firm of Spies & Co. and have commenced business at 87 and 89 West Van Buren street, Chicago. They announce that they are prepared to undertake the manufacture of electrical work and specialties and they solicit the opportunity to estimate on such work as electrical instruments, telephone parts and appliances, experimental work and light manufacturing in metals.

Judge Giegerich has appointed Wilbur Larremore receiver for J. B. Colt & Co., manufacturers of focusing lamps, stereopticons and scientific apparatus, New York, on the application of the directors of the company. The receiver's bond was fixed at $40,000. It was said that the corporation had been unable to procure additional capital; that in the summer the demand for the products of the concern fell off considerably and business has been conducted at a loss. The liabilities are said to be about $90,000.

BUSINESS.

C. H. Worcester & Co., Koss, Mich., are receiving their full share of the cedar-pole business. They have a large territory to draw from and promise prompt shipments.

Gale's commutator compound, manufactured by K. McLennan & Co. of Chicago, is going to a daily increasing list of users. As is well known, this compound prevents sparking and will keep commutators in good condition. Samples will be cheerfully mailed on request.

Charles Landis, treasurer of the American Reflector and Lighting company of Chicago, reports that the demand for reflectors and shade-holders was never so great as it is at present. It is needless to say that the American company is receiving the share of business to which its excellent reputation entitles it.

The Rolfe Electric company, Chicago, manufacturer of the Rolfe protectors, which are designed to prevent sneak currents, lightning, power and lighting currents from injuring telephone, telegraph, fire-alarm and similar instruments, is meeting with flattering success in its new field. Great interest is taken in the Rolfe protector, and those interested may obtain a copy of the company's handsome catalogue on application.

The George C. Towle Manufacturing company, Lancaster, Pa., states that over 10,000 of its well-known power motors are now in use. This motor is guaranteed electrically and mechanically and is said to be giving the best of satisfaction. The Towle motors are made in sizes of from one-twelfth to one horse power. The company will be pleased to mail illustrated descriptive catalogue to intending purchasers or others interested in this class of apparatus.

For a third of a century the name "Sturtevant" has been associated with fan blowers, heating, ventilating and drying systems and the like. To-day, however, the name has added significance, for it is also suggestive of high-grade steam engines, electric motors and generating sets. For years the Sturtevant engine has been gradually developed and perfected, while the past decade has witnessed the rapid growth of the electrical department of the B. F. Sturtevant company. At the present rate of development this department bids fair to overtop all other lines of manufacture in this well-known establishment.

The Western Electrical Supply company of St. Louis reports that its general supply business has never been better. The telephone department is said to have grown beyond all precedent and is crowded with orders. Especial attention has been devoted to this department, and the company has done everything possible to keep it up to date. The firm attributes a great deal of its fall business to the unprecedented demand for its new 1900 telephone, with its moisture and damp-proof transmitter. This telephone is said to embody, as its name implies, all the latest and best improvements which have been made in the telephone.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 3, 1899.

634,023. Electric Signal for Railways. Thomas H. Patenall, Easton, Pa., assignor to the Union Switch and Signal company, Swissvale, Pa. Application filed January 17, 1899.

A signal for a block system is described which consists of an oscillatory semaphore arm connected to an electric motor by means of an auxiliary shaft. This shaft has a worm wheel on one end engaging with a gear on the armature shaft and a worm gear at the other end engaging with a disk connected with the semaphore arm. An electrically controlled lever holds a dog in engagement with serrations or teeth on the worm wheel on the disk.

634,057. Electric Switch. William Ely, Providence, R. I. Application filed February 4, 1898. Renewed February 27, 1899.

The switch combines contact posts and contact members, a gear-segment lever, an engaging arm in positive connection with the contact members, a hand-operated lever, the actuating gear-segment lever being loosely connected with the lever with the required degree of backlash

and a spring connecting the ends of the gear-segment levers.

634,085. Electric Arc Lamp. Adolph Hamacek, Sturgeon Bay, Wis. Application filed May 12, 1899.

Parts of the lamp are a solenoid, a resistance device, an armature or plunger actuated by the solenoid, a carbon carrier and a connected clutch, a counterbalancing lever flexibly connected with the carrier and adapted to counterbalance the weight of the carrier, and a dashpot having its piston connected with the carrier. (See cut.)

634,095. Electric Annunciator. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed February 4, 1892.

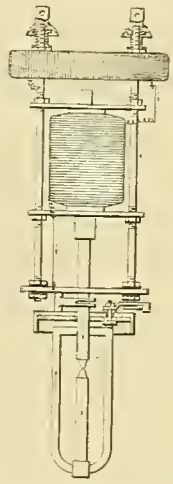
There are combined with a supporting plate, two electromagnets mounted heel to heel on opposite sides thereof, the armatures of the magnets and the hook or latch extending from one armature to normally engage with the armature of the other to hold the same from falling, and circuits through the different magnets, whereby when current is sent through the magnet having the latch or hook, the armature of the other magnet is released, the armature being restored when current is sent through the electromagnet.

634,118. Danger-signal System. Wilbur Mayes, Omaha, Neb. Application filed September 6, 1898.

An electrical signaling system for railways is described which has combined with circuit-closing switch devices, signal mechanisms located between the switch devices, and a normally open electric circuit including the switch devices and the signal mechanisms, one of the switch devices being arranged to initiate a circuit by a train moving in one direction, and the other switch device being arranged to complete the circuit by a train moving in the opposite direction.

634,157. Electric Arc Lamp. James M. Willard, Decatur, Ill. Application filed July 11, 1898.

One claim reads: An arc-lamp feeding mechanism, comprising means for connecting the carbons, whereby they may be moved toward each other as consumed, and a motor for actuating the mechanism comprising a coil located in a shunt circuit, a core or armature for the coil, an actuating lever connected to the core, means for moving the lever in opposition to the attraction of the coil, a dashpot connected with the lever, whereby a slow movement is imparted thereto, a circuit-breaking device for the shunt circuit, and means controlled by the movement of the actuating lever for positively and instantaneously operating the circuit-breaking devices.



NO. 634,085.

634,165. Portable Electrical Drilling Machine. Alphonse L. Croneau, Paris, France. Application filed June 23, 1899.

Apparatus for drilling metal sheets or plates is described which has a magnetic adhesion device for keeping the surface to be drilled against the drilling tool. This device consists of a metal platform suitably supported by a single wheel and two electromagnets constituting the feet of the machine, and serving to produce the requisite adhesion of the machine to the surface to be drilled, a bracket carrying the drilling tool fixed on the platform immediately over the electromagnets, so that the drill operates between these, an electric motor fixed on the rear part of the platform connected to the driving shaft of the drilling tool by an elastic coupling resistance and a commutator included in the supply circuit of the motor and electromagnets.

634,169. Flexible Electrical Conduit or Tube. Edwin T. Greenfield, New York, N. Y. Application filed July 17, 1899.

A flexible metallic conduit or tube is constructed of spirally wound strips having their edges serrated and turned up and down.

634,187. Railway Signal. James Sargent, Rochester, N. Y., assignor to the Sargent Automatic Railway Signal company, Rochester, N. Y. Application filed April 22, 1899.

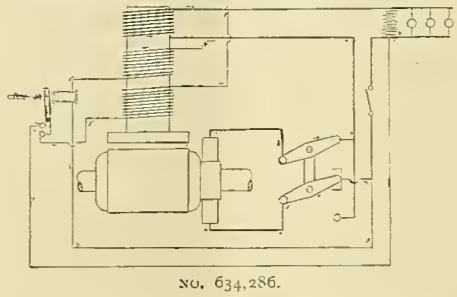
In a railway signal are combined with the semaphore, the lamp and their connecting magnetism, a motor for throwing the signals into the "safety" position, a magnet for locking the signals in that position, a battery for the motor and magnet, and a device for switching the current from the motor to the magnet, and vice versa, comprising contact plates, a sliding switch pin and a pair of arm members connected with the semaphore and arranged to move the switch-pin back and forth in contact with the plates as the semaphore nears the end of its travel in opposite directions.

634,198. Method of and Means for Preventing Electric Sparking. Charles L. Buckingham and Emil Germann, New York, N. Y., assignors to the Western Union Telegraph company of New York. Application filed June 26, 1896.

The inventors describe a method of protecting contacts against destructive sparking in circuits, including electromagnets or solenoids traversed by currents which would otherwise produce such sparking, which consists in winding the magnets with two or more wires and connecting the wires in such manner that when two are employed the terminal end of the first shall be joined with the beginning of the second, or when three are employed the terminal of the first shall be joined with the beginning of the second and the terminal of the second with the beginning of the third, and so on, depending upon the number of strands employed, the reciprocal action of the windings upon each other serving to practically neutralize the tendency to destructive sparking.

634,220. Electric Signaling Apparatus for Elevators. James B. Smalley and Charles A. Reinders, Chicago, Ill., assignors to the Elevator Supply and Repair company, Chicago, Ill. Application filed September 22, 1898.

The apparatus comprises push button or like mechanism and visual signals such as lanterns located at the floors of a building and a commutator mechanism for controlling the passage of current through the signals. The commutator mechanism comprises a screw shaft, a carrier nut mounted upon the shaft and arranged to move in unison with the elevator car, contact brushes carried by the carrier nut and contact plates with which the brushes engage, the contact plates being arranged in correspondence with the floors of the building and being in circuit with the visual signals, whereby as the brushes pass over the plates the passage of current through the individual circuits of the visual signals is determined.



NO. 634,286.

634,226. Electric Switch or Signal Apparatus. Fred Andrews, Chicago, Ill., assignor of one-half to the Elevator Supply and Repair company, Chicago, Ill. Application filed September 3, 1898.

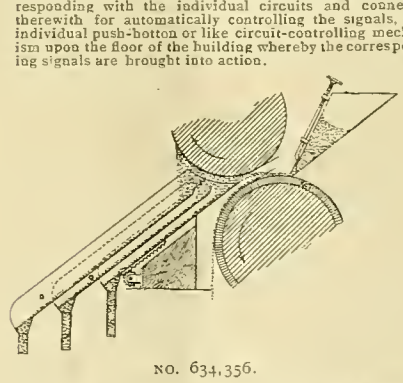
A switch comprising a movable contact arm and means for shifting the arm back and forth is combined with means to engage the end of the contact arm and so direct its movements in different paths, contact plates arranged along the different paths of the contact arm, and suitable means whereby the contact plates and the contact arm may be connected with the electric circuit.

634,227. Electric Signaling Device for Elevators. Charles G. Armstrong, Chicago, Ill., assignor to Earl W. De Moe, Chicago, Ill. Application filed May 6, 1897.

Features of the device are a plurality of electrically operated switches corresponding with the floors of a building, magnets for actuating the switches, electric circuits wherein the magnets are placed, circuit-closers at the individual floors for controlling passage of current through the magnets, a commutator operated by the elevator mechanism and having a plurality of contact plates corresponding with the floors and severally in circuit with the switches, an electric lamp on the car and an electric circuit for the lamp independent of the switch-actuating circuit and serving to connect the lamp with the commutator.

634,229. Electric Signaling Apparatus for Elevators. Samuel D. Collett, New York, N. Y., assignor to the Elevator Supply and Repair company, Chicago, Ill. Application filed September 3, 1898.

There are combined in the apparatus two series of individual signals, one series serving for "up" signal service and the other signal serving for "down" signal service and both grouped within the car, electric circuits wherein the signals are placed, the circuits comprising individual wires connecting with the corresponding individual signals within the car, a source of current common to the individual circuits, a commutator operatively connected to the elevator mechanism and provided with devices corresponding with the individual circuits and connected therewith for automatically controlling the signals, and individual push-button or like circuit-controlling mechanism upon the floor of the building whereby the corresponding signals are brought into action.



NO. 634,356.

634,231. Electric Belt. Lester A. Dixon, Marshall, Mich., assignor to Andrew Chrystal, Marshall, Mich. Application filed June 6, 1899.

The belt comprises a battery, a conductor in electric contact with one pole of the battery, a depending flap carried by the belt, a vertically adjustable second conductor adapted to be placed in contact with the body of the wearer, and a connection between the second conductor and the opposite pole of the battery.

634,258. System for Power Transmission for Electric Traction. Emile Bede, Brussels, Belgium. Application filed September 23, 1897.

The roadbed of an electric railway is combined with a conductor suitably located therein, the conductor being provided with an insulating sheath having boxes or enlargements at intervals inside of which the conductor is bare, the boxes being provided with openings, rubber stoppers in the openings, plates covering the stoppers, contact pieces or plungers passing through the stoppers and being insulated thereby, the pieces or plungers provided with buttons on their outer ends which pass through the cover plates and abut against the rubber stoppers, the plungers adapted to be forced into contact with the bare conductor by the passing vehicles, and removed therefrom by the elasticity of the rubber acting against the buttons.

634,286. Electric-lighting System for Cars. John L. Creveling, New York, N. Y. Application filed July 15, 1899.

A main circuit contains a dynamo, a storage battery and an electric make-and-break switch. The dynamo has a field-energizing coil or coils in a derived circuit across the mains between the generator and the switch, and a field-energizing coil or coils in a derived circuit from the battery, in combination with an electromagnetic switch adapted to close the derived circuit when excited by current generated in the dynamo armature and to open the circuit when the current ceases to flow. (See cut.)

634,295. Reflector for Incandescent Lamps. Walter Goodchild, Wyoming, N. J. Application filed February 11, 1899.

The bulb of an incandescent lamp is combined with a light reflector, which fits snugly but removably over the external surface of the downwardly flared upper part of the bulb and is supported wholly and directly thereon.

634,314. Electric Arc Lamp. Christian Tepel, Bennett, Pa. Application filed November 18, 1898.

The lamp consists of a pivoted carbon holder, a clutch lever pivoted thereto and fulcrumed at a point farther from its connection with the carbon holder than the carbon holder is fulcrumed, a clutch, and a link pivotally connecting the clutch to the clutch lever.

634,315. Electric Seam-calking Tool. Eddy T. Thomas, New York, N. Y., assignor to the Electric Stone Cleaning and Renovating company, Jersey City, N. J. Application filed December 4, 1895.

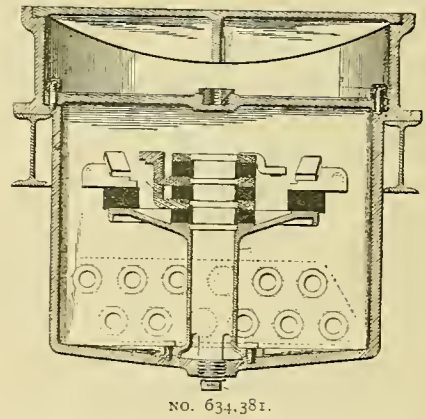
The tool has a rotatable arbor, a cam fixed to the arbor and a fan to blow away the dirt and scales, in combination with a tool carrier slidably supported and having a lug in close proximity to the cam, and a spring to force the carrier forward.

634,316. Sign. Charles C. Whelan, Washington, D. C. Application filed October 26, 1898. Renewed July 6, 1899.

Electric means are provided for producing an air-blast which is used to discharge air currents against opposite sides of a display pennant or streamer.

634,356. Electromagnetic Apparatus for Separating Ores. Emil Kreuser, Mechernich, Germany. Application filed February 28, 1899.

An ore separator is described which consists of two revolving cylindrical electromagnets arranged one above the other and having cylindrical polar surfaces, the rotation of which produces a magnetic field bulged in the direction of rotation, a cylindrical, non-magnetizable covering tightly fitting the lower cylindrical polar surface to weaken its magnetic attraction relative to that of the upper cylinder polar surface which raises the ore particles consecutively through polar fields of gradually decreasing strength, and inclined chutes arranged to correspond accurately with the several zones of the separated falling ore particles. (See cut.)



NO. 634,381.

634,381. Junction Box for Manholes. Joseph W. Turner, New Orleans, La. Application filed July 17, 1899.

For an underground electrical system, a manhole is designed which consists of a junction box supported in the upper portion of the manhole, having wire connections accessible from the interior of the manhole, and provided with a cover allowing access to its interior from the exterior of the manhole. (See cut.)

634,388. Railway Signal. Wilfrid S. Boult, London, England, assignor of one-half to Cedric Randal Boult, Liverpool, England. Application filed December 30, 1897.

A railway signal combines with an electromagnet, a magnet, a focusing collector having a gap wherein a deflectable needle is situated, one member of the combination being in the roadway and the other upon a vehicle movable past the first member.

634,403. Electrical Apparatus for Exhibiting and Changing Advertisements, Signs, or the Like. Arthur D. Douglass, London, England. Application filed April 11, 1899.

The invention consists of an electrically illuminated sign having in combination a drum with a plurality of studs in two or more series, a series of fingers pivotally arranged on a rod, a series of metallic pieces with which the fingers make electrical contact when operated by the studs on the drum, a series of circuit terminals connected to the metallic pieces and to the lamps, a battery having its poles connected to the lamps and pivoted fingers respectively, means for imparting intermittent revolution to the drum, and speed-controlling devices by which the speed of intermittent revolution of the drum is susceptible of being varied.

634,430. Electric Igniter for Gas Engines. Walter H. Cotton, Chicago, Ill. Application filed October 24, 1898.

The igniter has an armature provided with a means of adjustment, a movable electrode operatively connected with the armature, a fixed electrode projecting from a post which passes through and is insulated from a plate adapted to be secured to the cylinder of the engine, electromagnets secured to the plate electrically connected with a battery and adapted to provide energy for operating the movable electrode by means of the armature.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, OCTOBER 21, 1899. No. 17

Metropolitan Elevated Railway System.

Inasmuch as the power plant of the Metropolitan West Side Elevated Railway company of Chicago has been greatly enlarged this year, a general description of the system will be timely on the occasion of the assembling of the members of the American Street Railway association in convention in Chicago. This company was the pioneer in the introduction of electrical power on the elevated railroads of the United States, and it still operates the largest system of elevated electric railroads in the country, although the Manhattan system of New York, now building, will be much larger when completed. Lately the Metropolitan company, with the other elevated-railway companies of Chicago, has been enjoying a season of unexampled prosperity, and there is a persistent rumor that a consolidation of all five of the companies is being considered. However, this article has only to do with the construction and operation of the road.

The Metropolitan West Side Elevated Railway company obtained its ordinance from the city of Chicago in the spring of 1892, providing for a system of elevated lines on the West Side, to be built on private property, except at crossings of streets and alleys. Preliminary work was immediately begun and purchase of property was well under way by January, 1893. Actual construction was started in March of that year.

Structure and Track.

The general location of the line, with its several branches, is shown by the map on the next page (Fig. 4). The main line, extending from the Chicago River to Paulina street, has four tracks. A general view of the structure, looking west toward the power house, is given in Fig. 5. All branches are double-tracked. The main line runs near Van Buren street from Chicago River to Paulina street. The Garfield Park branch runs west to Forty-eighth avenue, near and parallel to Harrison street. The Northwest branch runs northwest to Robey street and Milwaukee avenue, and there forms the junction of Logan Square and Humboldt Park branches. The Logan Square branch runs parallel to Milwaukee avenue to Logan Square, and the Humboldt Park branch parallel to North avenue to the Chicago, Milwaukee and St. Paul railway. The Douglas Park branch turns south from main line at Paulina and Van Buren streets, and runs parallel to Paulina street to south of Twentieth street, thence west to Western avenue.

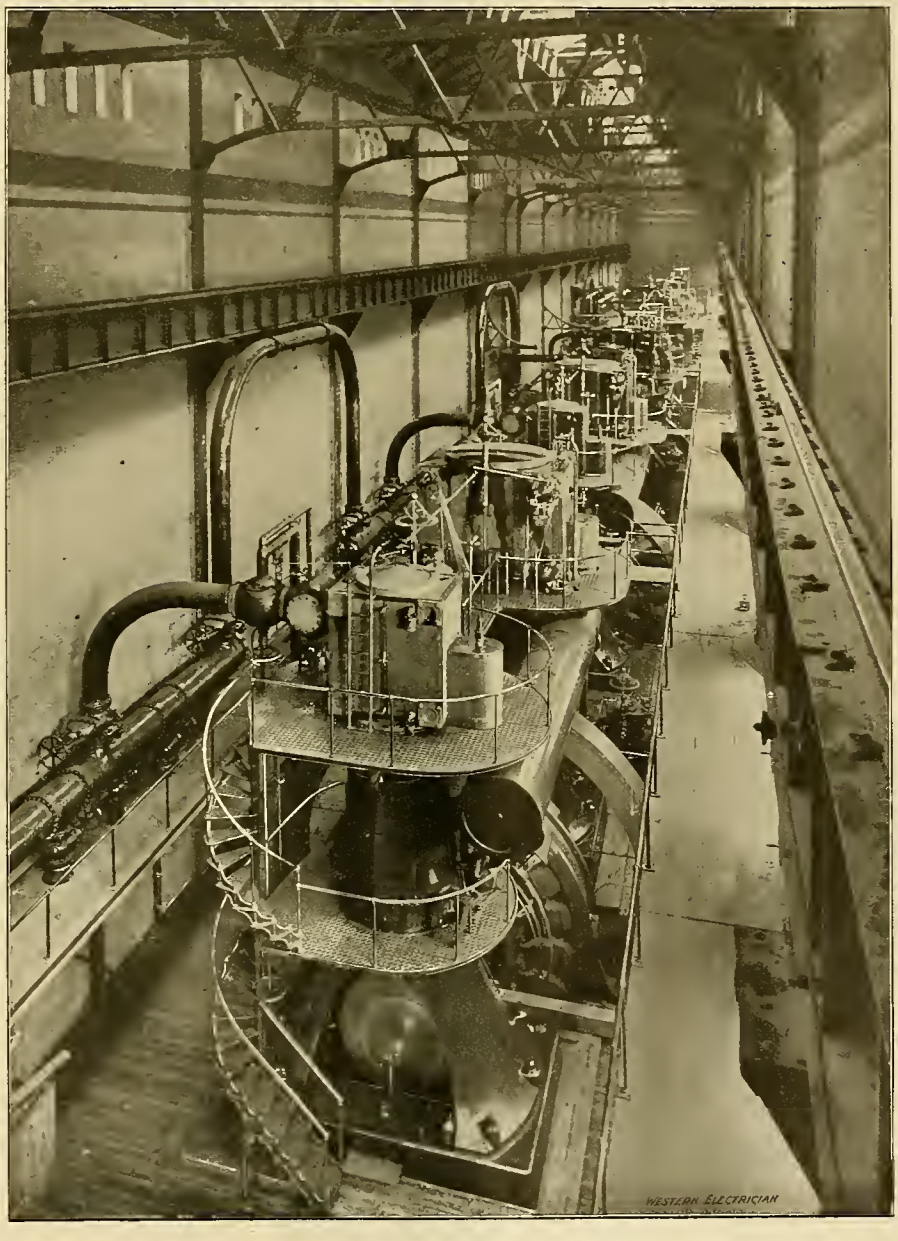


FIG. 1. METROPOLITAN ELEVATED RAILWAY SYSTEM.—VIEW IN ENGINE ROOM AT POWER HOUSE.

On May 6, 1895, the Northwest line was opened to Robey street, and later in the same month it was opened to Logan Square, being two years after construction was begun. The Garfield Park and Humboldt Park branches were opened in June, 1895. The Douglas Park branch was opened in the summer of 1896.

The structure consists mainly of steel girders resting directly on steel columns, all supported on concrete foundations. The average span length is about 45 feet. At railroad and boulevard crossings special structure is provided, that at the boulevards being decidedly ornamental in design, as may be judged by Fig. 6 (page 229), showing the crossing at Ashland boulevard.

The river crossing is probably the most interesting construction detail, as well as of vital consequence in operation. The bridge is of the roller-lift pattern and is probably best known as the Scherzer lift bridge. It is constructed in two sections, and the tracks to the bridge have crossings at each side, so that one half may at any time be temporarily taken out of use. The bridge is operated by electric motors and controlled by air brakes. Each quarter is arranged to be operated independent of the others, if required. However, in ordinary use the two quarters on one side of river are coupled together and operated as one side. Each quarter has an independent motor. All locking at heel and center is done by air pressure. Track signals are interlocked with bridge signals in such manner as to prevent track signals going to safety until bridge is down and locked in position. The bridge may be opened and closed in less than a minute. The east and west halves of bridge are each operated from a tower at the respective side of the river. The operation of the bridge has at all times been satisfactory and repairs on structure and machinery have been nominal. In Fig. 7 are two views of the bridge, showing it open and closed.

Track is laid with 80-pound steel rails on yellow-pine ties, each tie being bolted to longitudinal girders. Each track rail has two lines of eight by six-inch yellow-pine guard rail laid parallel to it and bolted to ties. At all curves the inside rail is provided with a steel guard rail.

Station buildings are located on the surface, connecting with the different platforms by stairways. The buildings are substantial brick buildings, neatly finished and heated by hot water from hot-water heaters in the basement. There are 39 stations in all. The downtown terminal was, until October, 1897, at the east side of Franklin street, between Jackson and Van Buren streets. At that time the connection with the Union Loop was completed, the first Metropolitan train passing around loop on October 11, 1897. The terminal station at Franklin street was thereafter abandoned, as the trains of all branches run direct around entire loop.

From the loop junction the length of the various branches is as follows: Garfield Park branch, 5.9 miles; Logan Square branch, 6.2 miles; Humboldt Park branch, 6.66 miles; Douglas Park branch, 4.2 miles. The main line (loop junction to Paulina street) is 1.88 miles in length. The entire distance around the loop is two miles. The whole Metropolitan system, exclusive of loop, consists at present of 16.9 miles of double track (sidings and yards not included). Yards and motor-inspection houses are built at Logan Square and at West Forty-sixth avenue. Each yard has a capacity of about 50 cars. Each inspection house has a capacity of about 12 cars. Inspection houses are used for systematic inspection of motors. Inspection pits are further provided at each terminal for inspection and attention to motors while in service.

The Humboldt Park and Logan Square branches and the Garfield Park and Douglas branches are operated in conjunction with each other; that is, trains are run from Humboldt Park branch terminal around loop to Logan Square, and from Garfield Park terminal around loop to Douglas Park branch terminal.

Electrical Equipment.

As originally constructed the road was intended for steam locomotives, and steam locomotives had actually been ordered when the management decided to use electricity as motive power. The use of electricity for operating an elevated road was at that time, if not entirely an experiment, at least a step beyond anything in actual service. The Intramural road at the World's Fair had been erected and operated as a short, temporary line for several months. Other than this there had been no extensive experiment in connection with this particular kind of service. There is no doubt that the successful operation of the Intramural road was largely responsible for the introduction of the present system on the Metropolitan. The company spared neither pains nor expense to bring both structure and equipment to the highest possible standard.

The power house (Fig. 3) is located between Throop and Loomis streets, on the main line, and from it current is directly transmitted into the feeder system and contact rails. The current is carried to the car motors through a contact shoe attached to the axles of the trucks. The controlling apparatus is in cabs at the ends of the car. The contact shoe slides on the contact rail. It is sus-

pended from links which permit of vertical movement. The contact rail is supported on insulators placed outside of the wooden guards for the track rails. The top of the contact rail is about nine inches above the base of track rail. Current is carried to ends of the various lines through feeders, consisting of 75-pound rails packed so as to occupy as little space as possible, and laid on top of insulating blocks fastened to ties between the tracks. These feeder rails are enclosed by wooden box (sides and top), the top forming a board walk.

For electrical operation the entire road is divided into six sections. Each section is fed through a circuit-breaker at the power house. The maximum drop in feeder system is 50 volts. The normal pressure at power house is 600 volts. Contact rails weigh 48 pounds per yard and are laid in 30-foot lengths. They are connected by iron splice bars and have a copper-plate bond riveted to base with copper rivets. The structure is used for return current. All expansion joints of structure have copper bonds riveted to them. At the crossing of the Chicago River wires in armored cables were laid for both positive and negative connection at the bridge.

Fig. 3. The Power House.

METROPOLITAN ELEVATED RAILWAY SYSTEM.

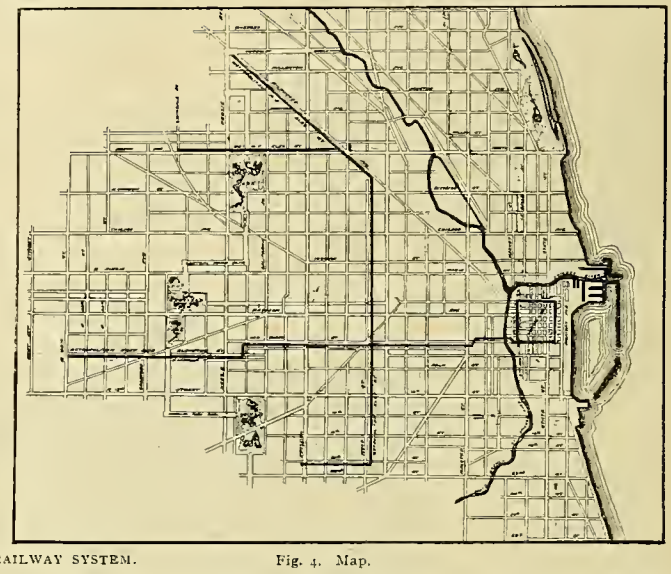


Fig. 4. Map.

Generating Plant.

The power house is of steel framework, enclosed with brick. It is of peculiar section on account of its location between the tracks of the company. The main portion of building, the engine room, is 36 feet wide and 70 feet high. The boiler room is located at the north side of engine room and part of it is under the north pair of tracks. The coal room is directly over boiler room, containing coal bunkers, with coal track. Coal is brought into the coal room directly from a coal elevator at Forty-sixth street (shown in Fig. 8), where it is hoisted from the ordinary coal cars into special dump cars for elevated service. Ordinary coal cars are of too great a width to clear station platforms. The special coal cars are side-dumping and empty by gravity into coal bunkers at the power house. Each car has a capacity of about 16 tons. The coal track at power house has a track scale for the purpose of weighing all coal delivered to the plant. The coal used is what is known as "washed screenings" and is obtained from various mines in Illinois. The average coal consumption per day of 24 hours is at present about 100 tons.

As originally designed and constructed, the plant occupied a length of 300 feet in the block between Loomis and Throop streets. The remaining 150 feet at each end was left for future extensions. The west extension has just been erected and the station is now 450 feet long. Fig. 3 gives a good idea of its length and height in comparison with surrounding buildings.

The central part of the engine-room basement contains pumps, tanks, heaters, etc., with sufficient space for additions to accommodate the entire plant extended in both directions. The switchboard is also located in the center of the building, being about 16 feet above engine-room floor. The switchboard gallery is 50 feet long and carries six feeder panels, two reserve panels for "jumper" connections, three blank panels for future use and six generator panels. All circuit-breakers, meters, etc., for switchboard were furnished by the General Electric company.

The original installation of generating units in 1895 consisted of two 800-kilowatt and two 1,500-kilowatt machines, a total of 6,000 horse power. The generators are of General Electric make and the engines were furnished by the E. P. Allis company. One 800-kilowatt and one 1,500-kilowatt machine was placed on each side of the center of building. The engines are vertical cross-compound and direct-connected to generators. Each engine has a separate condenser pump.

Water for condensing purpose is obtained from a seven-foot shaft at power house, which connects with a five-foot tunnel constructed under right-of-way of the company to the Chicago River. The length of tunnel is about 6,600 feet. Water is drawn directly from shaft through a 24-inch suction pipe, which has branches with check valves connecting to the various condenser pumps. The overflow from condensers is carried through a private 30-inch sewer to the city service in Harrison and Van Buren streets. The power house has further connection to city water mains for the purpose of supplying water to boilers. There are two separate connections, one to the Loomis street main and one to the Harrison street main.

An overhead crane travels the entire length of the engine room. The height of crane is sufficient to clear the upper part of the tallest engine with any possible section of machinery. This crane was furnished by the Morgan Engineering company and is operated by electric motors, each movement being controlled by separate motor.

In the summer of 1898 the west extension of power house was begun. This became necessary to provide for the increasing traffic. The building was extended west to Loomis street and arrangements were made to install two additional large units, providing room for an additional unit of same size later. These two units have now been put in and are in operation. The generators are General Electric 1,650-kilowatt machines and the engines are the Allis company's make, similar to those in the old section of the house. Thus the present capacity of plant is nominally 10,000 horse power. The general view of engines and generators in Fig. 1, on the first page, is an impressive picture of the enlarged plant.

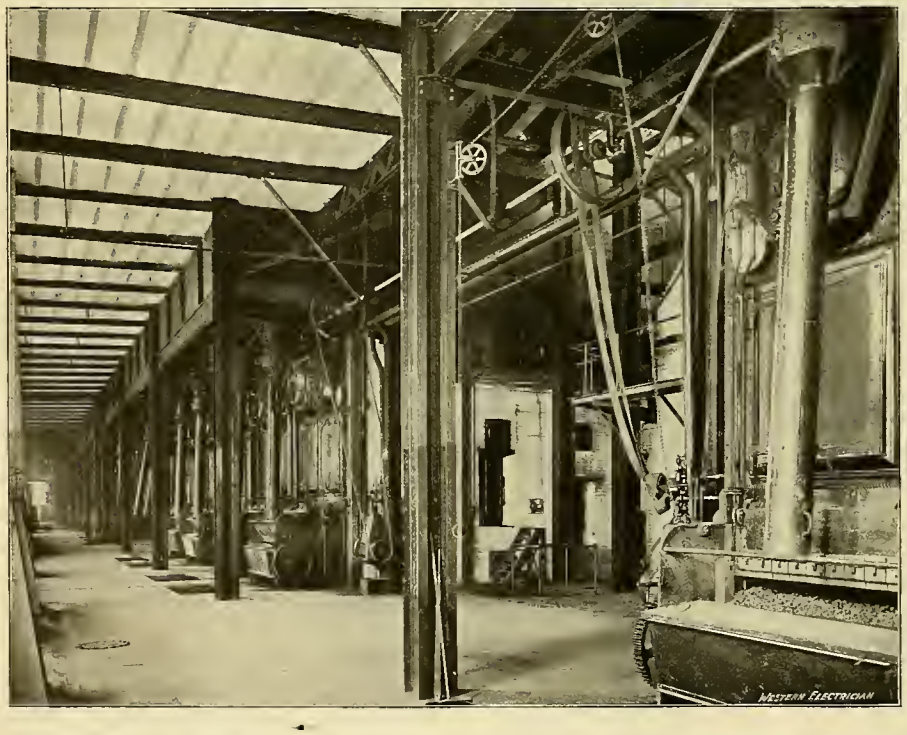
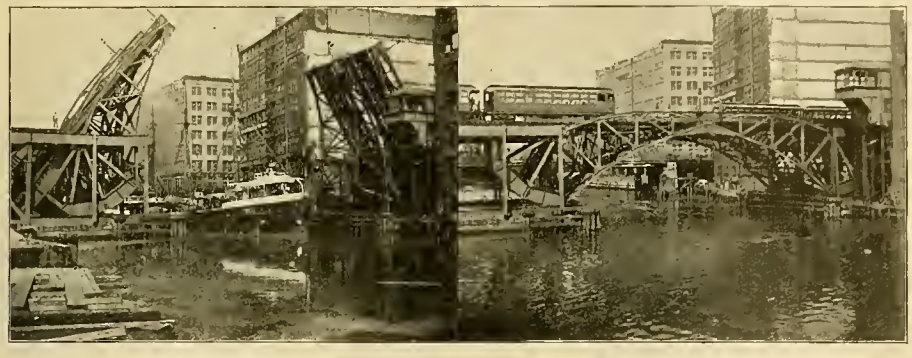


FIG. 2. METROPOLITAN ELEVATED RAILWAY SYSTEM.—BOILER ROOM IN POWER HOUSE.

FIG. 5 METROPOLITAN ELEVATED RAILWAY SYSTEM.—GENERAL VIEW OF TRACK STRUCTURE; POWER HOUSE IN THE DISTANCE.

The boiler room (Fig. 2) contains at present 10 batteries of Babcock & Wilcox boilers, each battery having a nominal rating of 600 horse power. Each battery has two Babcock & Wilcox chain-grate stokers, and coal is fed to stokers through coal chutes from bunkers above. Stokers empty ashes in a cast-iron hopper at rear end, which discharges the ashes into a conveyor, which carries them up through the coal room and dumps them into an ash car standing on coal track. The conveyor has cast-iron overlapping buckets and is about 1,100 feet long. It is of C. W. Hunt company's design and was erected by the Macdonald Engineering company of Chicago. The boiler room further is provided with two Sturte-

vant blowers for supplying forced draft to boiler furnaces. Air is forced through an air tunnel, running full length of building in front of boilers, and is admitted to furnace through valves set in cast-iron ducts, connecting with the tunnel. Six batteries of boilers (three on each side) obtain their draft through the east stack. The remaining four batteries are connected (two on each side) to the west stack. Space for two additional batteries is provided and these boilers will connect with the west stack. The flues are in rear of boilers and are connected to stack through economizers; they have also a direct opening into the stack, acting as a by-pass around the economizers. The economizers are located on coal-room floor, one on each side of each stack, four in all. The two economizers at the east end have 440 pipes each, while the two at the west end have 320 pipes each. The scrapers of the economizers are operated by electric motors. There is one motor to each pair of economizers. The economizers were furnished and erected by the Fuel Economizer company, Matteawan, N. Y.



Bridge Open. Bridge Closed.

FIG. 7. METROPOLITAN ELEVATED RAILWAY SYSTEM —ROLLING LIFT BRIDGE ACROSS CHICAGO RIVER.

Two smoke stacks, made of steel and lined with four inches of common brick, are now used. The steel shell and brick lining of the stacks rest on steel columns. The lower portion of the stack, containing the flue openings, usually termed the stack breeching, is built of brick with cast-iron curved cover plates. The stacks are 13 feet in diameter inside and are 150 feet high above boiler-room floor.

Steam from boilers goes direct to a main steam header, which runs the full length of the building along the north wall of the engine room. The entire length of the header, which is 18 inches in diameter, is about 400 feet. Expansion of header is taken up by three loops. All steam for engines is taken out of the top of the header, and all steam for other pumps, etc., is taken from the lower side of steam main.

Oil for lubrication is stored in tanks in a small building east of power house. It is forced from these tanks by air pressure into smaller tanks in the engine room, near the center of the building. From these tanks the oil flows by gravity to small oil pumps, which maintain a constant pressure in the oiling system of the power house. The pumps are in duplicate and are automatically controlled to insure pressure within limits. The pressure for engine oil is 60 pounds per square inch and on cylinder oil 200 pounds per square inch. This oiling system carries oil to all bearings, cylinders, etc., of the entire plant.

FIG. 6. METROPOLITAN ELEVATED RAILWAY SYSTEM.—ASHLAND BOULEVARD CROSSING.

Feed water is taken from surge tanks and pumped through heaters into economizers, from which it is drawn into boilers. The average temperature of water as it comes from heaters is about 130 degrees. Steam pressure is carried at 160 pounds.

The current output during the day, other than during "rush hours," will average about 5,000 to 7,000 amperes. During "rush hours," however, heavy "swings" will reach 14,000 amperes. Engines and generators are guaranteed to stand 50 per cent. overload.

Car Equipment.

The car equipment consists of 63 motor cars and 186 coaches. Trains consist of one motor car with one to four trailers. The minimum length of train is two cars. Five-car trains are run night and morning. The motor cars are used as smoking cars. The coaches or trailers are of standard elevated-railroad pattern, weighing about 33,000 pounds empty, and seating 48 people. The coaches were built by the Pullman company and Harlan & Hollingsworth company. Motor cars are similar to trailers, but have cab at each end for motorman and controlling apparatus. They are also strengthened by a steel sub-frame. Trucks are of special design to carry motors and were built by the Baldwin Locomotive Works. The trucks carrying "G E 2,000" motors have 5½-foot wheel-base and those having "G E 55" or Walker motors have a wheel-base of six feet. Wheels of motor trucks are 33 inches and of passenger trucks 30 inches in diameter. All motor-car bodies were built by the Barney & Smith Car company of Dayton, O. The company has three types of motors in operation, "G E 2,000," "G E 55" and "Walker 20 L." Most of the "G E 2,000" motors are placed four to a car. "G E 55" and Walker motors are operated, with one pair to each car. Two motors are mounted on one truck. The trailer truck of motor car, however, is of same construction as motor truck, so as to permit of placing motors on it later, if desired. Two "G E 55" or Walker motors haul a five-car train without any trouble.

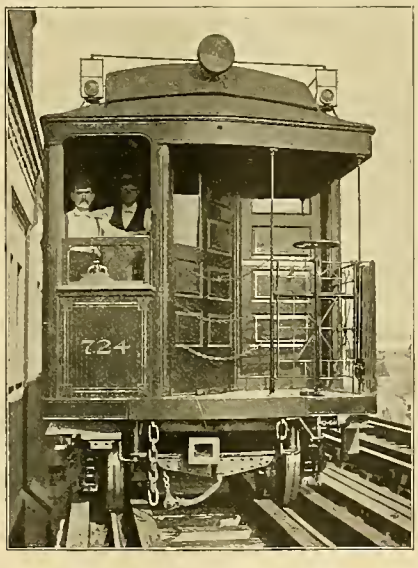


FIG 9. METROPOLITAN ELEVATED RAILWAY SYSTEM.—CAR FRONT, SHOWING MOTORMAN'S CAB

The controlling apparatus is placed in cabs at ends of motor cars, as shown in Fig. 9. It consists of "G E" series parallel controller, circuit-breaker, fuse box, switches, etc. Switches in cab will permit cutting out either one of the pair of motors and car may be hauled with remaining motor. Resistance boxes are hung from lower side of car body. Each cab has a complete set of controlling apparatus, including air-brake valve.

The brakes are operated by "straight air" and are controlled by valve in motor cab, the air being supplied to train from reservoir under motor car. An air pump, operated by an electric motor, is placed in one cab of each motor car, supplying air to reservoir of car, maintaining a pressure of 60 pounds. The pump is controlled automatically and ordinarily does not require the attention of motorman. The reservoir has a capacity of 15 cubic feet and the pump is of capacity sufficient to raise pressure in reservoir from atmosphere to 60 pounds per square inch in 2½ minutes.

The brakes were furnished by the New York Air Brake company and pumps by the Christensen Engineering company of Milwaukee, Wis. The cars are heated and lighted by electricity. Each motor car carries a headlight and two colored markers or lights, designating the branch to which train is running.

The average speed of trains, including stops, is 15.4 miles per hour, the average distance between stops being 2,000 feet. Trains are operated at short intervals during the entire day and continue at longer intervals during the night. The intervals after 1 a. m. are 30 minutes between trains of each branch, or 7½ minutes on main line between trains going in one direction.

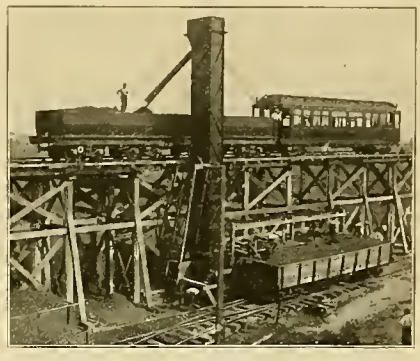


FIG. 8. METROPOLITAN ELEVATED RAILWAY SYSTEM.—ELECTRIC COAL HOIST.

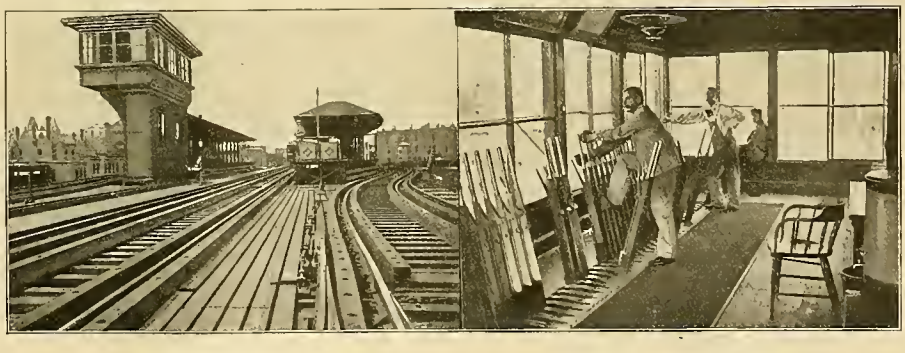
The car or repair shop is located on the main line, between Center avenue and Throop street. It consists of a substantial two-story brick building, 300 by 50 feet. Cars are run into shop at track grade and trucks of motor cars are lowered to shop floor by means of hydraulic lift. Car bodies are not lowered to first floor. All repair work to motors and motor trucks is done on first floor. Paint shop is located at west end of car shop and has room for three cars. Capacity of car shop, exclusive of paint shop, is about 13 cars.

Interlocking.

The interlocking of special track work, with signals, is very extensive and complete. There are altogether four distinct interlocking plants (exclusive of two river-bridge towers and all loop towers) on this road. One is at Market street, where four tracks connect into two tracks of loop connection. Another is at Canal street, operating combination cross-over west of river on viaduct of Pennsylvania Railroad yards. A third—the one shown in Fig. 10—is at Marshfield avenue, operating junction turn-outs and crossing of Garfield Park and Douglas Park branches. There is also the combination cross-over at Ashland boulevard and one at North avenue, near Robey street, operating cross-over and turn-out in connection with junction of Humboldt Park and Logan Square branches.

All switch towers, as well as all other principal buildings in connection with the road's operation, are connected by a telephone system. The interlocking plant was installed by the National Switch and Signal company.

The interlocking plants insure a rapid and safe train movement across crossings and special track



Interlocking Tower. Interior of Interlocking Tower

FIG. 10. METROPOLITAN ELEVATED RAILWAY SYSTEM.

work. Trains are further protected in their movements by the Rowell-Potter block signal, which automatically protects the rear end of trains passing signal. Only one train is permitted in the "block" at one time, and signal in rear of train cannot be released until train passes release point at fixed distance beyond second signal; that is, a train cannot release its protecting signal in rear until it has passed a second signal, on account of release point being beyond second signal. The signal is operated in detail electrically from storage batteries. The initial operation for each set of movements, however, is performed by wheel of truck passing over a tread bar at side of track rail. Any failure in the operation of mechanism will leave signal at danger, thus insuring safety at expense of all else. The failure of motorman to obey signal is further provided against by attaching a tripping bar to signal, which bar, when signal is at danger, will raise a plunger attached to truck if truck passes signal at danger. The plunger operates a valve which throws on air brakes of train.

General Operation.

Every possible effort has been put forth in the construction and operation of this system to afford its patrons a safe and quick means of reaching the heart or business district of the city, or between points on its various branches. Passengers may transfer to and from all branches without additional fare. This company does not use tickets, passengers paying their fare on entering station, which fare is registered by agent.

The road passed into the hands of a receiver in January, 1897, and was operated by the receiver until February, 1899. During the receivership connection was made with the loop, improving materially the downtown terminal of the road. Trains are operated around the loop under lease, the several elevated roads having jointly leased the tracks of the Union Elevated Railroad company. In February, 1899, the road passed from the receiver into the hands of the reorganized company.

Traffic has increased more than 80 per cent. in the last two years, and the daily average is now reported as more than 80,000 passengers. During the summer the company has added 36 cars and 16 motors to its equipment to accommodate its increasing business. The company has further made considerable improvement, in the way of track alterations on the main line, to permit of greater freedom in the movement of trains, and with the additional power and equipment, now practically ready for service, the company hopes to increase further the efficiency of the service.

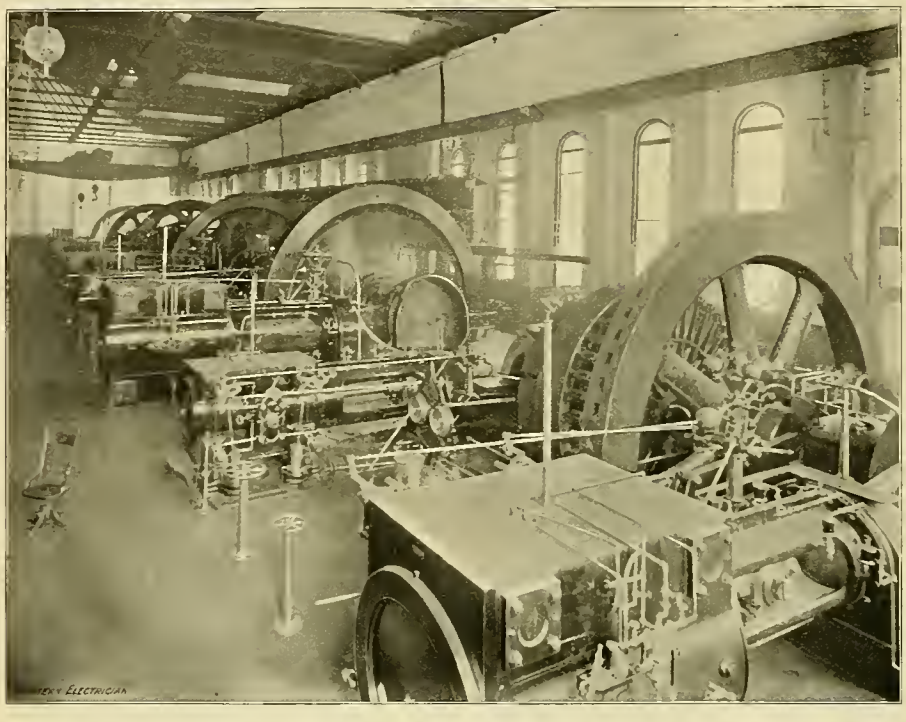
The officers of the company are: President and general manager, D. MacAllister; secretary and treasurer, George Higginson, Jr.; assistant general manager, H. M. Brinckerhoff; superintendent of transportation, A. S. Jones; chief engineer, W. S. Menden.

The threatened suits against the Western Union Telegraph company by the State Railroad Commission of South Carolina, which has the power to fix rates, has been obviated by an agreement, after several months of legal sparring. The commission reduced the rates to 24 cents to make the company pay the revenue stamp. A compromise has been effected by leaving the 25-cent rate as it was and reducing the rates that were 40 cents to 25 cents, so that all points within the state have the same rates.

Western Avenue Station of Chicago Union Traction Company.

One of the largest of the power plants that furnish power for the different surface street-railway systems operating in Chicago is the Western avenue station of the Chicago Union Traction company. This station is located near the corner of Western avenue and Washington boulevard, and supplies current for all the surface lines in that vicinity. The area reached by the feeders from the power house is about 25 square miles and extends between North avenue and Twenty-sixth street, east to the Chicago River and west to about Fortieth avenue. The electric-railway lines thus supplied are parts of the West Chicago Street Railroad company's system, now distinguished as the West Side lines of the Chicago Union Traction company, which recently secured control of most of the West and North Side surface roads. In addition to the power furnished to the West Side lines the Western avenue station supplies current to the Lake Street elevated railroad between Chicago River and Fifty-second or Robinson avenue. About 35 per cent. of the total output of the station is used by the Lake street line.

The equipment of the Western avenue power house, which is a building 125 by 250 feet in size, comprises 20 400 horse power Stirling boilers set in batteries of two each and six direct-connected engine and generator units, giving a total capacity of 10,800 horse power. The accompanying illustration gives a general view of the engine room. There were originally installed four units, one of 750-kilowatt capacity and three of 1,500 kilowatts each. In 1897 a 1,200-kilowatt unit was added and during the present year a 1,500-kilowatt generator was installed, thus completing the equipment of the station as originally designed.



WESTERN AVENUE STATION OF CHICAGO UNION TRACTION COMPANY.

All of the engines are of the cross-compound, non-condensing type. The first four installed were built by Fraser & Chalmers. Of these the smaller one is of 1,000 horse power, with cylinders 26 inches and 40 inches in diameter and a 48-inch stroke, running at 80 revolutions a minute. It is directly connected to a 750-kilowatt, 12-pole Siemens & Halske generator of the external-armature type. The other three engines are rated at 2,000 horse power each, with dimensions of 34 by 54 by 60 inches and running at a speed of 75 revolutions a minute. They are each connected to a 1,500-kilowatt generator of the Siemens & Halske type. The recently installed generators are of the same type, but the engines are of different makes.

Engine No. 5 was built by the Corliss Steam Engine company and is rated at 1,800 horse power. It has cylinders 32 and 50 inches in diameter and a 60-inch stroke. The last engine installed is a 2,000 horse power Corliss, built by the Pennsylvania Iron Works company. It is 34 by 54 by 60 inches in size.

The main switchboard of the Western avenue station consists of 76 feeder panels of the General Electric type. Below the main board is located the generator switchboard, consisting of seven panels, one for each generator and one for the total output.

The remainder of the equipment of this station consists of Berryman heaters, Westinghouse separators and return loops, Blake admiralty pumps, Metropolitan injectors, a Wilson-Whiting-Davis oiling system and the usual steam piping and electric wiring.

American Street Railway Association.

The official programme of this week's meeting of the American Street Railway association at Tattersall's, Chicago, as prepared by Secretary Penington, is as follows:

Tuesday.

10 a. m. Meeting called to order by Charles S. Sergeant of Boston, president.
Address of welcome.
Calling of the roll.
Invitation extended to join the association.
Address of the president.
Report of the executive committee.
Report of the secretary and treasurer.
Paper—"Investments in Street Railways: How Can They Be Made Secure and Remunerative?" Charles T. Yerkes, Chicago.
Reception at Auditorium parlors, 8:30 p m.

Wednesday.

Convene at 10 a. m.
Paper—"Maintenance of Car Equipment," J. H. Van der Veer, Brooklyn Heights Railroad company, Brooklyn, N. Y.
Paper—"Modern Street Railway Shop: Its Design, Machinery and Shop Practice," B. L. Kilgour, chief electrician Cincinnati Street Railway company, Cincinnati, Ohio.
Appointment of committee on nomination of officers and selection of next place of meeting.
1:30 p. m. Trip to Drainage Canal. Train leaves Santa Fe (Polk street) depot at 1:30 sharp; return at 5 p. m.

Thursday.

Convene at 10 a. m.
Paper—"Construction and Maintenance of Street-railway Track," Edward Butts, Metropolitan Street Railway company, Kansas City, Mo.
Paper—"Train Service and Its Practical Application," Ira A. McCormack, general superintendent Brooklyn Rapid Transit company, Brooklyn, N. Y.
Election of officers for ensuing year.
1:45 p. m. Tallyho ride through Jackson Park.
2 p. m. Trolley ride to Stock Yards. Attendants will be on hand to show all the points of interest at one of the great industries of the city.
8 p. m. Theater party. Tickets will be distributed at the hotel. Those intending to go are asked to make up parties and get tickets accordingly.

Friday.

This is Supply Men's Day. The entire day is to be given to the examination of the exhibits which are shown by the supply men. This is also Ladies' Day. The ladies will be taken to the principal stores, Art Institute and Lincoln Park. Carriages will be in waiting at the hotel at 10 a. m. This is for the ladies only; gentlemen are requested to visit the hall and let the ladies have the benefit of carriage rides.
7 p. m. Annual banquet at the Auditorium. Installation of the officers-elect at the banquet.

Officers and Committees.

The officers of the association for the year ending October 18th were as follows:
President—Charles S. Sergeant, Boston.
Vice-presidents—Henry C. Moore, Trenton, N. J.; Ernest Woodruff, Atlanta, Ga.; Walton H. Holmes, Kansas City, Mo.
Secretary and treasurer—T. C. Penington, 2020 State street, Chicago.
Executive committee—The president, vice-presidents and Albion E. Lang, Toledo, Ohio; George A. Yuille, Chicago; Frank G. Jones, Memphis, Tenn.; John I. Beggs, Milwaukee; Ira A. McCormack, Brooklyn.

The general committee of arrangements for the Chicago convention has worked hard to make the gathering a success. It consisted of John M. Roach, vice-president and general manager North and West Chicago Street Railroad companies, chairman; George A. Yuille, second vice-president West Chicago Street Railroad company, secretary and treasurer; George O. Nagle, assistant general manager Chicago City Railway company; H. M. Sloan, general manager Calumet Electric Street Railway company; H. H. Windsor, editor Street Railway Review; F. L. Fuller, general superintendent West Chicago Street Railroad company; James R. Chapman, general manager electrical department North and West Chicago Street Railroad companies; T. C. Penington, treasurer Chicago City Railway company. Portraits of all these gentlemen, with the exception of Mr. Fuller, who has left town, are presented in the accompanying group. Mr. M. K. Bowen was originally the chairman of the committee, but his lamentable death occurred early in the year.

The ladies' reception committee was made up of Mrs. J. M. Roach, Mrs. Frank R. Greene, Mrs. J. Chas. Moore, Mrs. J. W. Buell, Mrs. M. B. Starring, Mrs. J. R. Chapman, Mrs. W. A. McGuire, Miss M. A. McGuire, Miss E. B. McGuire, Miss M. Willowby, Miss Frances Byrne, Mrs. H. H. Windsor, Mrs. J. Samuel Sheahan, Mrs. Clift Wise, Mrs. R. H. Prince, Mrs. Robt. McCulloch, Miss Bessie Felton, Mrs. George A. Yuille, Mrs. Theo. P. Bailey, Mrs. B. E. Sunny, Mrs. T. C. Penington, Miss Maude Penington, Mrs. C. R. Penington, Mrs. Z. E. Knapp, Mrs. W. J. Cooke, Miss M. E. Cooke, Mrs. Clay Crawford, Miss Estelle Johnson, Mrs. Geo. A. McKinlock, Mrs. W.

Worth Bean, Miss Keith Bean, Mrs. F. S. Kenfield, Mrs. J. N. Hobbs, Mrs. R. E. Richardson, Mrs. H. A. Marsh, Mrs. H. M. Sloan, Mrs. W. A. Harding, Miss Edna Kimmell, Mrs. G. W. Knox, Mrs. C. N. Duffy, Miss Clara Cunningham and Mrs. Raymond.

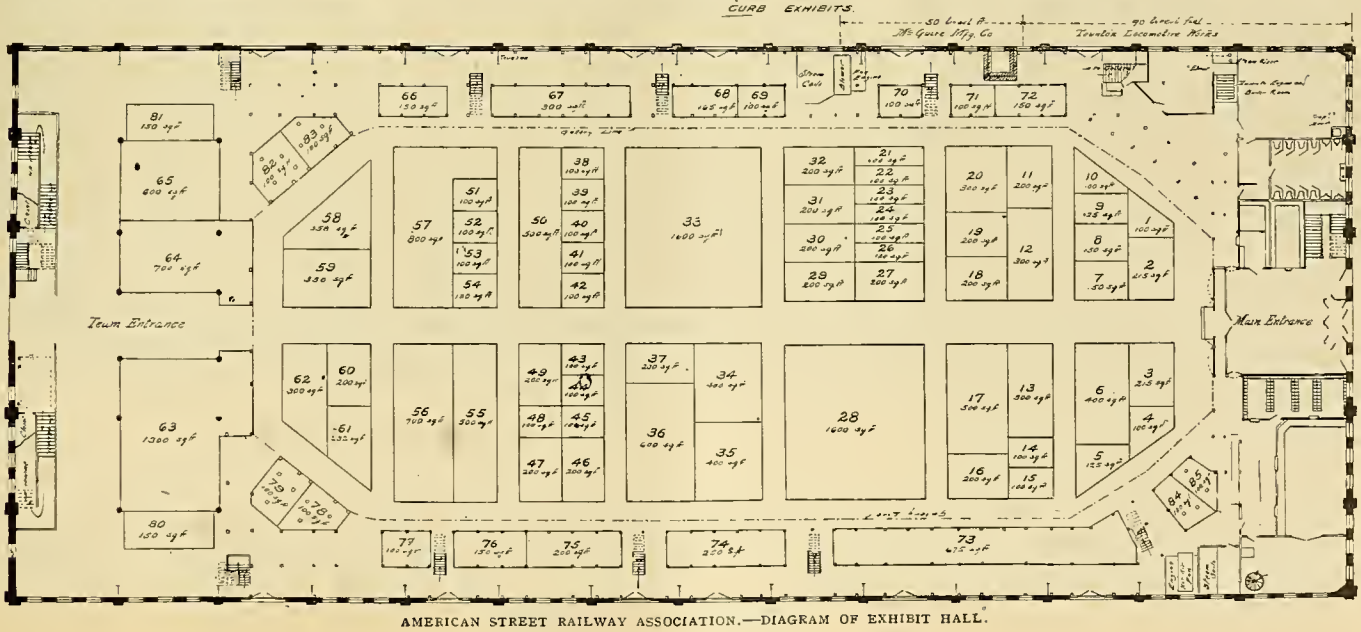
H. M. Sloan. Geo. O. Nagle.
T. C. Penington. J. M. Roach, Chairman. Geo. A. Yuille, Secretary.
H. H. Wiodsor. J. R. Chapman.

AMERICAN STREET RAILWAY ASSOCIATION.—GENERAL COMMITTEE OF ARRANGEMENTS.

No. of Space.	List of Exhibitors. Exhibitor.	Sq. Ft.
1.	C. F. Orr & Co.	100
2.	Street Railway Review	215
3.	Street Railway Journal	215
4.	K. McLennan & Co.	100
5.	W. R. Garton company	125
6.	Electric Railway Equipment company	400
7.	Electrical Review Publishing company	150
8.	Railway World	150
9.	Safety Insulated Wire and Cable company	125
10.	Novelty Tufting Machine company	100
11.	Mica Insulator company	200
12.	Manville Covering company	300
13.	R. D. Nuttall company	300
14.	Charles N. Wood	100
15.	American Protected Rail Bond company	100
16.	Creaghead Engineering company	200
17.	Ohio Brass company	500
18.	Consolidated Car Heating company	200
19.	Gold Car Heating company	200
20.	Haywood Bros. & Wakefield company	300
21.	American Rail Joint and Manufacturing company	100
22.	A. & M. Brake Shoe company	100
23.	Hale & Kilburn company	100
24.	Pantasote company	100
25.	E. T. Burrows company	100
26.	Curtain Supply company	100
27.	Adams & Westlake company	200
28.	General Electric company	1,600
29.	Harold P. Brown	200
30.	Standard Paint company	200
31.	Central Electric company	200
32.	Garton-Daniels Electric company	200
33.	Westinghouse Electric and Manufacturing company	1,600
34.	The Falk company	400
35.	American Steel and Wire company	400
36.	The Consolidated Car Fender company	600
37.	Dearborn Drug and Chemical Works	200
38.	American Mason Safety Tread company	100
39.	Standard Underground Cable company	100
40.	American Car and Foundry company	100
41.	Adam Cook's Sons	100
42.	Leschen-Macomber-Whyte company	100
43.	National Lead company	100
44.	Continuous Rail Joint Company of America	100
45.	American Railway Supply company	100
46.	International Register company	200
47.	Ohmer Car Register company	200
48.	R. Bliss Manufacturing company	100
49.	Meaker Manufacturing company	200
50.	Barney & Smith Car company	500
51.	Garl Electric company	100
52.	Paige Iron Works	100
53.	Milwaukee Rail Joint and Welding company	100
54.	Watson-Stillman company	100
55.	G. P. McGann Air Brake company	500
56.	Christensen Engineering company	700
57.	McGuire Manufacturing company	800
58.	Standard Air Brake company	250
59.	Pennsylvania Steel company	460
60.	Griffin Wheel company	200
61.	W. T. Van Dorn & Co.	232
62.	Pennsylvania Car Wheel company	300
63.	Lorain Steel company	1,300
64.	Dorner Truck and Manufacturing company	300
	Taylor Electric Truck company	400
65.	Hipwood-Barrett Car and Vehicle Fender company	600
66.	Cling-surface Manufacturing company	150
67.	Wm. Wharton, Jr., & Co.	300
68.	Charles Scott Spring company	165
69.	H. M. Stiles	100
70.	American Brake Shoe company	100
71.	Ironsides company	100
72.	Siegrist Lubricator company	150
73.	Morris Electric company	675
74.	Crane company	250
75.	Cylindorama Railway company	100
	Star Brass Works	100
76.	American Vitrified Conduit company	150
77.	New Haven Car Register company	100
78.	Chapman Valve Manufacturing company	100
79.	United States Rocking Grate Bar company	100
80.	J. R. McCardell & Co.	150
81.	Baltimore Car Wheel company	150
82.	Miller-Knoblock company	100
83.	Major Cement company	100
84.	Weber Rail Joint Manufacturing company	100
85.	Joseph Dixon Crucible company	100

Curb Spaces.—West Side of Building.

Taunton Locomotive and Manufacturing company ..... 90 feet x 10 feet
McGuire Manufacturing company ... 50 feet x 10 feet
Taylor Electric Truck company .... 50 feet x 10 feet



AMERICAN STREET RAILWAY ASSOCIATION.—DIAGRAM OF EXHIBIT HALL.

Chicago and Milwaukee Electric Railway.

THE double-track southern extension of the Chicago and Milwaukee electric railway, extending from Highwood to North Evanston, Ill., has been completed, and cars are now being operated over the road from Evanston to Waukegan. The road now in operation is 26½ miles long and runs north from Evanston, paralleling the tracks of the Chicago and Northwestern railroad, through Wilmette, Kenilworth, Winnetka, Lakeside, Glencoe, Ravinia, Highland Park, Highwood, Fort Sheridan, Lake Forest, Lake Bluff and North Chicago, ending at Waukegan. These towns all border on Lake Michigan, and are nearly all residence suburbs of Chicago. Fort Sheridan is a government reservation and military post, and North Chicago and Waukegan are manufacturing towns. The name of the road would indicate the connection of Milwaukee with Chicago by a continuous electric railway. An electric line is now operating between Milwaukee and Kenosha, leaving but 10 miles between Kenosha and Waukegan to be built to complete the northern end of a Chicago and Milwaukee road. The company is not considering any extension north at present, but has made plans to connect its southern terminus with the Northwestern elevated railroad, now building in Chicago, thus giving access to the center of the city.

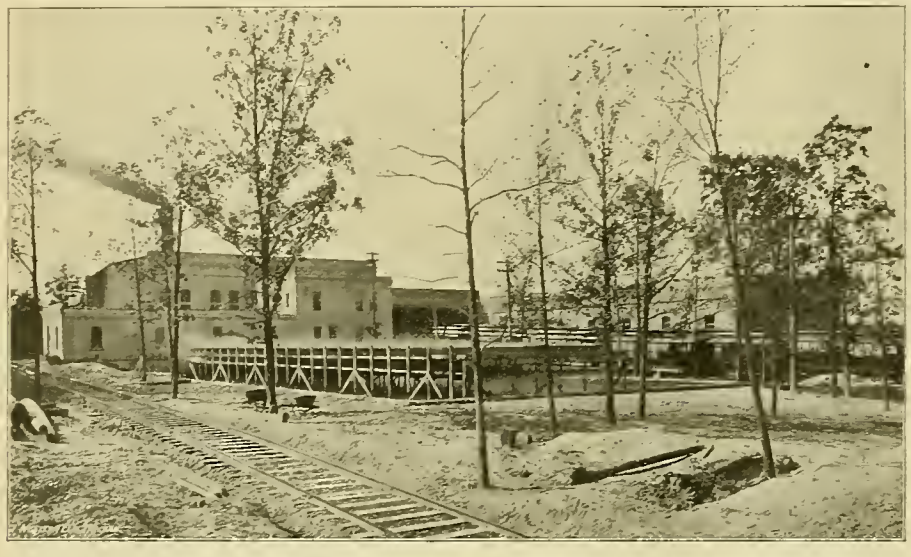


FIG. 3. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—POWER HOUSE AND CAR BARNS AT HIGHWOOD (COOLING TABLE IN FOREGROUND).

For electric-current supply a combination direct-current and three-phase alternating-current system is used. This system is diagrammatically represented in Fig. 1. The main generating station or power house is situated near the middle of the line at Highwood. Here are installed a direct-current generator, used to supply the line in the vicinity of the station, and two alternating-current generators, which furnish current, transmitted over two three-phase transmission lines, to sub-stations, near either end of the line. Storage-battery auxiliaries are used in both power house and sub-stations. The auxiliary stations are located at Winnetka and North Chicago and contain rotary converters which change the three-phase alternating to direct current. The direct current for the operation of the cars is supplied from these sub-stations and the main power house by the usual system of feeders extending in both directions. As shown in Fig. 1, the road is divided into six feeder sections, two from each of the sub-stations and the power house. The lengths of the feeder wires supplying each section, the distances between stations and the ends of the road, as well as the size and length of the alternating-current transmission wires, are indicated in the drawing, Fig. 1.

Power Plant at Highwood.

At Highwood, where the power house is located, are also the offices of the company, the car barns and repair department. Fig. 2 shows a plan of the buildings and yards. The plant is situated just west of the route of the road. A switch track runs to the rear of the buildings from the Chicago and Northwestern railroad. Fig. 3 is a photographic view of the company's buildings at Highwood. In the foreground is seen the cooling table and reservoir, and beyond are the office and storage-battery building and the power house itself. The car barns, with a number of the summer type of cars, are seen in rear and to the right of the cooling table. The power house is built of brick and has a steel trussed roof. It is 108 by 80 feet in ground dimensions and can be easily added to, as the south wall is only of a temporary construction. A brick wall divides the building into a boiler room, 50 by 80 feet in size, and an engine room, 58 feet wide and 80 feet long. Fig. 4 (p. 233) shows a plan of the power house, while Fig. 5 (p. 234) gives a vertical cross-section through the building. In the boiler room there are three Cahall boilers of the Babcock and Wilcox water-tube type, built by Aultman & Taylor. They are fitted with Hawley down-draft furnaces and each is rated at 250 horse power. Two of the boilers are set in a battery and all three are so constructed as to be entirely independent of the brick-work. They are thus free to contract or expand, and the brickwork may be entirely removed and replaced, if necessary, without disturbing the boilers or connections.

The boiler room is designed to hold eventually four batteries of boilers. A steel stack of sufficient capacity to carry off the gases from eight boilers has been constructed. It will be midway between the four batteries when they are completed. The stack is 50 feet in height, and the gases are mechanically exhausted through it by means of an 84-inch Sturtevant steel-plate three-quarter-housing fan. A six by nine-inch engine drives the fan with a maximum speed of 235 revolutions per minute. An automatic Foster valve, attached to the steam header, controls the revolutions of the engine. As the steam pressure in the boilers falls the speed of the engine and consequently of the fan is accelerated, and, vice versa, with an increase of steam pressure the fan is retarded.

A Green fuel economizer is now being erected at the back of the boilers. When completed the connections will be so arranged that the gases from the furnaces may be discharged through the economizer or directly through the fan. Fig 6 is an illustration of the boiler room, showing the boilers, stack, fan and a part of the economizer erected above and at the back of the boilers. As shown in Figs. 2 and 4, a side track of the Chicago and Northwestern railroad runs along the west side of the power house, from which coal cars can be directly unloaded into the boiler room.

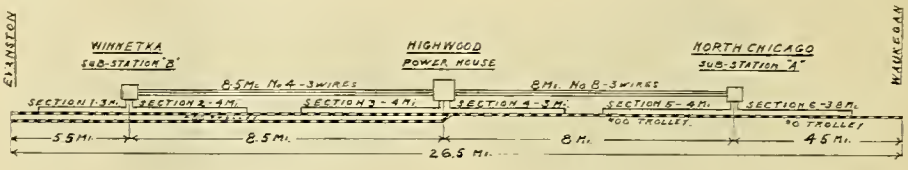


FIG. 1. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—DIAGRAM OF CURRENT TRANSMISSION AND DISTRIBUTION.

The general arrangement of the engines, generators and steam auxiliaries is clearly shown in Figs. 4 and 5. The auxiliaries—condensers, boiler pumps, feed-water heaters, etc.—are placed in a basement beneath the engine room. In the engine room proper (Fig. 7) there are two horizontal, tandem-compound, condensing, Corliss engines, made by the Filer & Stowell company of Milwaukee. These engines, operated at a steam pressure of 150 pounds, are direct-connected to multipolar generators by the Arnold system.

Referring to Fig. 4, the north engine or No. 1 is a 400 horse power side-crank Corliss, with cylinder dimensions of 17 by 30 by 36 inches. Its flywheel rim is square in section and weighs 40,000 pounds. It is a two-part wheel and is 14 feet in diameter. The engine is regulated by a Proell inverted-type governor, fitted with automatic safety stops to prevent the engine running away. These stops block the governor balls up, except in the event of the governor belt breaking. The governor is arranged so as not to require handling at the starting or stopping of the engine. The south or No. 2 engine is a center-crank Corliss, and is rated at 800 horse power. Its cylinders are 22 by 38 by 42 inches in size and it has two flywheels, weighing 24,000 pounds each. The receiver of the engine is of the reheater type. When necessary this engine can be overloaded 50 per cent., while the 400 horse power engine is capable of standing a 100 per cent. overload. The larger engine is also fitted with a Proell governor.

As the station has both direct and alternating-current output, it follows that the generators are of two types. Two alternating, three-phase generators of General Electric make (Nos. 1 and 3 in Fig. 4) supply the transmission lines leading to the sub-stations. Each generator has a capacity of 250 kilowatts and runs at 125 revolutions per minute. They are 24-pole machines and therefore deliver the three-phase current at 25 cycles a second. The voltage of the generators is 5,500, which is also the potential of the transmission line, as no transformers are used. Generator No. 2 is a direct-current, 600-volt, 250-kilowatt, 10-pole machine, and supplies power for sections three and four (Fig. 1) of the trolley line, near Highwood. A small 125-volt exciter for each alternator is belted to the main shaft. It is possible that these exciters may be done away with soon, as the company is considering a proposition to rewind the fields of the alternators, so that the exciting current may be taken from the storage battery installed as a part of the power-house plant.

The engines and dynamos shown in Fig. 7 are arranged and connected on the Arnold system, with

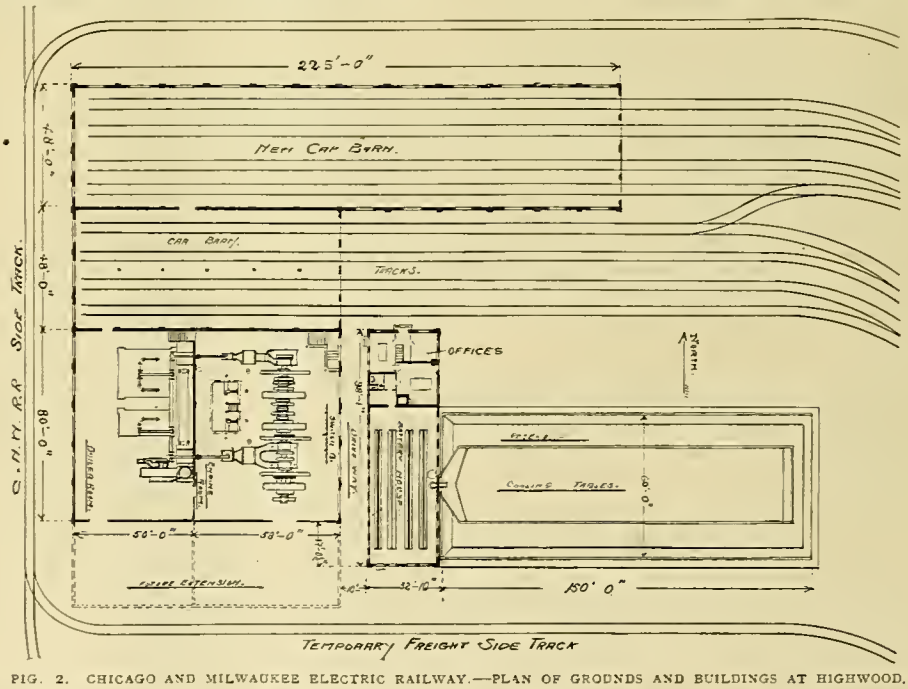


FIG. 2. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—PLAN OF GROUNDS AND BUILDINGS AT HIGHWOOD.

magnetic clutches. The cross-sectional drawing given in Fig. 8 shows the essential features of the apparatus. This drawing shows the armature of each generator mounted upon a hollow shaft or quill, through which extends a solid shaft. It is this interior solid shaft, which can be operated independently of either generator quill, that allows the flexible arrangement of engines and generators peculiar to the Arnold system. The solid shaft is carried in two bearings near its center, and under ordinary running conditions it lies idle in these bearings, adding no frictional load to the plant. Under every-day running conditions, each generator is operated by the engine adjacent to it, in a manner similar to a direct-connected plant. But in case of emergency or light load, either generator shown in Fig. 8 can be disconnected from its contiguous engine and connected to the interior solid shaft. This shaft can then be revolved by the other engine, and thus the load on either generator can be transferred at will from one engine to another. By this arrangement, then, it becomes possible to operate two generators from the small engine and three generators from the large engine.

The connections between the generator quills, the solid shafts and the engine flanges are made by means of three-way magnetic couplings, also shown in Fig. 8. These magnetic clutches occupy about 12 inches along the length of the shaft, and consist of two annular rings of cast-steel, each containing two coils, by means of which the clutches are energized. These coils are wound for 600 volts, so as to take their energy directly from the storage battery or the direct-current generator circuits. The current required is one-half ampere, and by means of this amount of current the clutch is capable of transmitting 500 horse power, so that the loss due to the clutch current is less than one-tenth of one per cent. of the power transmitted. Between the faces of the two field rings, and parallel to them, are carried two armatures, one connected by means of studs to the generator quill, and the other held in the arms of the hub, pressed on the end of the solid interior shaft. This latter armature is used to connect the solid shaft to either the generator or the engine. These connections are made and broken by the manipulation of a switch upon the station board, so that any generator can be thrown out of service without stopping its driving engine.

Blue Vermont-marble panels, on a frame of angle-iron, make up the power-house switchboard (Fig. 7), which is placed on the east side of the engine room. The board is composed of nine panels. Two are feeder panels of the standard General Electric make. The third (from the left) is a storage-battery panel, and is equipped with two single-pole switches and a double-reading ammeter. The direct-current generator panel constitutes the fourth, and the fifth is an exciter panel, provided with a voltmeter and ammeter. The sixth and eighth are alternating-current panels, equipped with voltmeters and ammeters, to indicate the output of the generators. On the seventh and ninth, or line panels, are mounted the instruments and controlling apparatus for the three-phase transmission lines leading to the sub-stations. A swinging voltmeter, attached to the end of the board, indicates the voltage of the direct-current feeders. Thomson inclined-coil, alternating-current instruments, Weston direct-current ammeters and voltmeters, with General Electric circuit-breakers and switches, are used. Oil switches are employed on the high-voltage circuits, and all the lines leading from the power house are provided with lightning arresters.

A separate brick building, east of the engine room. 98 by 33 feet on the ground, as indicated by the plan in Fig. 2, contains the offices of the company and a storage-battery room. The latter room is 64 feet long and contains 288 cells, each holding 11 type F plates of the Electric Storage Battery company, 10½ by 10½ inches in size. The battery serves as a regulator for the feeder circuits of the main power house. It acts as a reservoir, to which energy may be given and from which energy may be taken as the load varies, thus enabling practically a steady load to be maintained on the direct-current generator at all times.

Two car barns, each 48 feet in width, but 108 and 225 feet in length, respectively, join the power house on the north. Thirteen cars can be put in the smaller barn, while the capacity of the larger one is 25 cars. As indicated in Fig. 2, the Chicago and Northwestern railroad switch track on the west of the buildings is connected with tracks on the north and south sides of the grounds, so that, by using the main line, a loop is formed, by means of which cars may be turned around.

A cooling table and reservoir (see Figs. 2 and 3) are constructed east of the battery room. The reservoir is 160 feet long and 60 feet wide. A 13-inch brick wall constitutes the sides of the reservoir, and the bottom and sides are covered with six inches of concrete. The depth of the reservoir is eight feet. Inside of it rests a cooling table, 130 feet long and 30 feet wide, formed of three leaves. The discharged water from the condensers passes over these leaves and is cooled. It leaves the table

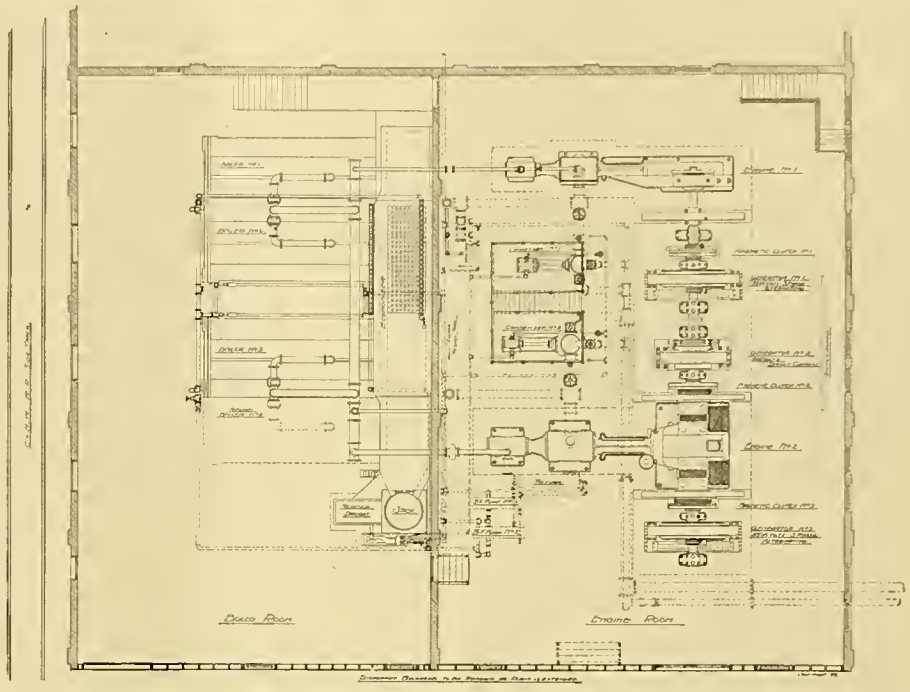


FIG. 4. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—PLAN OF POWER HOUSE AT HIGHWOOD.

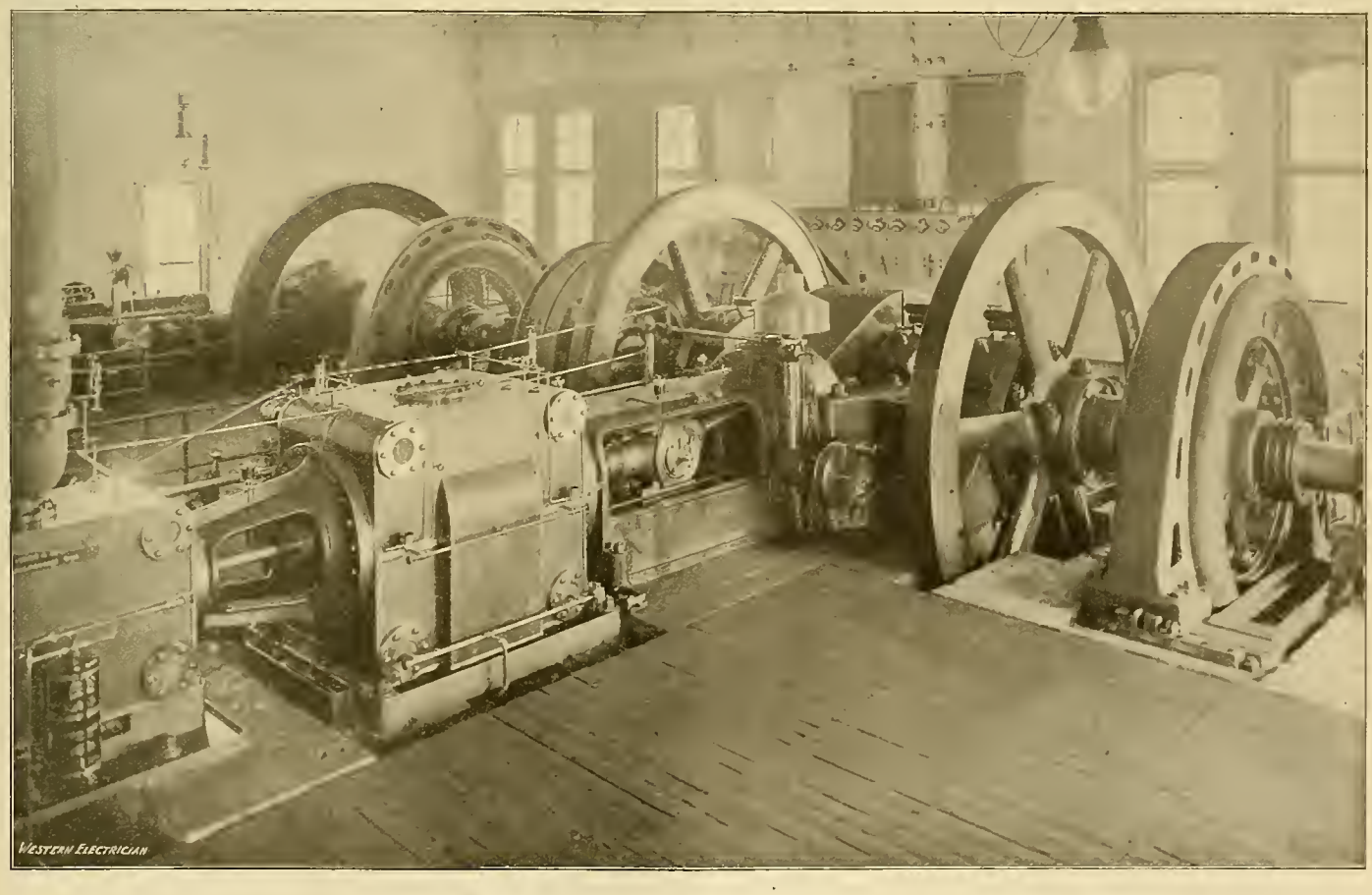


FIG. 7. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—ENGINES AND GENERATORS IN MAIN POWER HOUSE AT HIGHWOOD.

at the east end and falls into the reservoir. The injection water for the jet condensers is drawn from the west end of the reservoir. By means of this cooling system sufficient water is cooled to allow the condensers to maintain a 24-inch vacuum in the engine cylinders. Ordinarily, some of the water for the boilers is delivered from the condenser discharge, but in this plant all the water, obtained direct from the Highwood mains, is heated in an Excelsior open feed-water heater, by means of the exhaust from the steam pumps, air pumps and other auxiliaries, and is then pumped by Deane feed pumps directly into the boilers or through the economizer and then into the boilers.

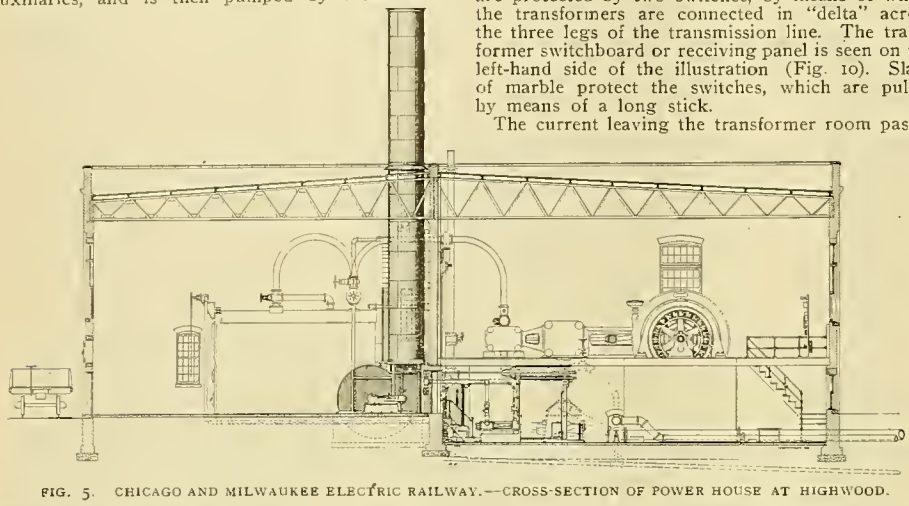


FIG. 5. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—CROSS-SECTION OF POWER HOUSE AT HIGHWOOD.

Overhead and Track Construction.

All of the three-phase transmission lines are bare copper wires, No. 4 being used on the line to Winnetka and No. 8 to North Chicago. The lines are not transposed, and so far no trouble has arisen on that account. No. 00 trolley wire is used for the entire line, with the exception of a portion at the north end. The overhead work is of the side-pole construction in the outlying districts, with center poles through the business centers of each town. Cedar poles are used for the side construction, while the center poles are of iron pipe, in three sections of five, six and seven-inch diameters respectively.

The high-tension wires are carried on double-petticoat glass insulators, on the cross-arms on the side poles, and are protected by lightning arresters. All of the poles are 30 feet in height, except those used for the transmission lines, which are 35-foot poles. Span wires of five-sixteenths-inch galvanized-iron wire support the trolley wire. Each pole is painted and those carrying the alternating-current wires have a danger notice stenciled upon them. H. W. Johns line material was used throughout for the overhead construction. Each of the six sections of the trolley is insulated from the others by Philadelphia break insulators, and switches, contained in locked boxes, on the side poles, are connected with the line sections, so that in case of an accident on one section it may be connected with the next, and thus receive power while the damage is being repaired.

In the track construction 65 and 72-pound T-rails and 85-pound girder rails are used, all of 60-foot lengths. The ties are of oak, spaced 24 inches apart.

Sub station Plant.

As typical of both, the sub-station located at Winnetka and called sub-station "B" is described. It is 8½ miles south of the power house, as shown by the diagrammatic map, Fig. 1, and is situated just east of the tracks. It is a brick structure, two stories high in front, with a one-story batery room in the rear. Fig. 9 (p. 235) gives a view of the exterior of the building.. Living rooms are provided on the second floor for the station keeper.

Fig. 10 is a view in the transformer room at Winnetka. This room is in the front of the building and is eight by 19 feet in size. It contains six static transformers of the General Electric type, with a capacity of 42 kilowatts each. Only five of the transformers show in the illustration. Current is received from the three-phase transmission line at 5,500 volts, and is transformed to the secondary voltage of 380. The terminals of each transformer are protected by two switches, by means of which the transformers are connected in "delta" across the three legs of the transmission line. The transformer switchboard or receiving panel is seen on the left-hand side of the illustration (Fig. 10). Slabs of marble protect the switches, which are pulled by means of a long stick.

The current leaving the transformer room passes to the two rotary converters in the next room through the first panel of the main switchboard. Fig. 11 is an illustration of the rotary converter room (19 by 23 feet in size), showing the converters and switchboard. Each converter is a six-pole machine and runs at 750 revolutions a minute. Alternating current is received at 380 volts, 25 cycles a second. The continuous-current capacity of each is 125 kilowatts, with a voltage of 600. The converters are of the General Electric type.

The switchboard is built of blue Vermont marble and consists of seven panels. The first and second panels, beginning at the left, control the alternating current going to the rotary converters and contain inclined-coil Thomson ammeters and three single-pole knife switches. Two standard General Electric direct-current panels, controlling the output of the converters, form the third and fourth panels. They are equipped with two single-pole switches, field switches, rheostats, direct-current ammeters (with illuminated dials) and circuit-breakers. A storage-battery panel, with two single-pole switches for cutting the battery in and out and a double-reading direct-current ammeter to indicate the charge and discharge of the battery, constitutes the fifth panel. The sixth and seventh panels are of the General Electric direct-current standard, fitted with switches, ammeters and circuit-breakers to control the feeders. A swinging voltmeter, indicating the direct-current voltage, is attached at the right end of the board, so it may easily be seen by the operator. All of the direct-current instruments are of the Weston make, while the alternating-current instruments are of the inclined-coil Thomson type. A Sturtevant pressure blower driven by a one horse power induction motor is used to cool the static transformers. It is situated on the right of the switchboard.

The sub-station battery room, illustrated in Fig. 12, is 30 feet wide and 66 feet long. It contains 288 glass cells of the Electric Storage Battery company's make. The cells each hold 15 type F plates, 10½ by 10½ inches in size, and are mounted on wooden trays filled with sand. The trays are supported on standard glass two-part insulators, the lower part being a saucer containing oil and the upper part a saucer inverted. This storage battery serves to steady or equalize the load of the stations in the same manner as the battery at the power house.

Sub-station "A," located near the southern limits of North Chicago, is a duplicate building of the Winnetka sub-station, with a car barn, 30 by 100 feet in size, attached, making the total dimensions of the building 64 by 100 feet. The barn holds four cars. A simple addition to sub-station "B" is contemplated. The power equipment of the North Chicago sub-station is identical with that at Winnetka, except that it is of half the capacity. But three static transformers and one rotary converter are installed. The storage battery is composed of the same number of cells, but each jar contains only seven plates, thus giving approximately only half the capacity.

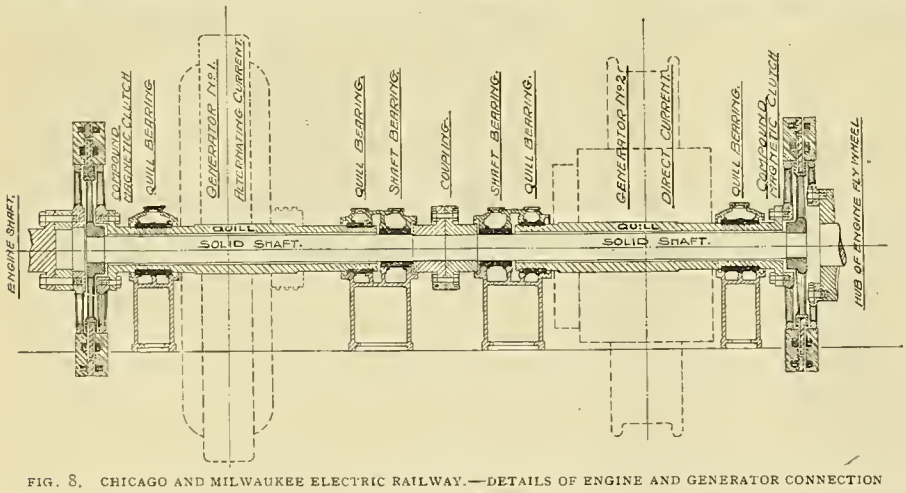


FIG. 8. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—DETAILS OF ENGINE AND GENERATOR CONNECTION IN POWER HOUSE.

Cars.

The rolling stock of the road is composed of 12 large double-truck motor cars, 12 large double-truck trailers, eight single-truck motor cars and six single-truck trailers—a total of 38 cars. The 12 large motor cars are combination baggage and passenger coaches and will seat 42 passengers each. One is shown in Fig. 13. The large trailers are 43-foot cars and each has a seating capacity of 56. These 24 cars were made by the Pullman company and are handsomely finished in natural wood. The car bodies are painted a royal blue with gold lettering. The single-truck cars were made by the St. Louis Car company and J. G. Brill & Co. The Pullman motor cars are provided with two 50 horse power General Electric motors and the single-truck motor cars are equipped with two 35 horse power motors of the same make. All the motor cars are equipped with Christensen air brakes. A rotary snow plow, a snow sweeper and a construction train complete the car equipment of the road.

To provide against breakdowns at the sub-stations it is planned to have in readiness at the power house a car equipped with a rotary converter, three static transformers, a switchboard panel and the necessary plugs and connections, so it can be sent to the seat of trouble and used to supply the power to the trolley until repairs can be made. It will be a movable sub-station entire, and as the storage battery at the damaged sub-station could be relied upon to furnish power until such a car could be sent to the station, it would hardly necessitate the shutting down of traffic at all, even in the case of a serious breakdown.

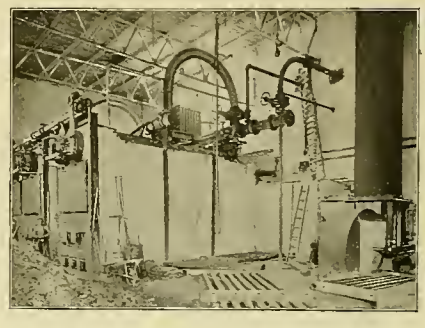


FIG. 6. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—BOILER ROOM AT HIGHWOOD.

Conclusion.

The mechanical and electrical equipment of the Chicago and Milwaukee electric railway was planned by Mr. Bion J. Arnold, consulting engineer for the company. The erection of this equipment—stations, machinery and line construction—was entrusted to the Arnold Electric Power Station company. It is believed that this is the first steam-driven electric railway to be operated on the plan of combining three-phase alternating-current transmission from one source of energy with direct-current distribution from sub-stations. It is interesting to note that if the common direct-current system, in which heavy feeders have to be used, had been installed the copper alone would have cost $80,000, or nearly four times the actual amount that was expended for copper.

A 10-minute schedule between Evanston and Highwood and a 20-minute schedule between Evanston and Waukegan are now being operated. A fare of five cents is charged between towns, while the entire line can be traveled for 35 cents.

The Chicago and Milwaukee Electric Railway company is capitalized at $1,000,000, and is the successor of the Bluff City Electric Street Railway company, whose property and franchises between North Chicago and Waukegan the new company purchased. The officers of the company are the following-named gentlemen: President, G. A. Ball, Muncie, Ind.; vice-president, A. C. Frost, Chicago; secretary, George M. Seward, Chicago; treasurer, J. W. Mauck, Highland Park, Ill.; general superintendent, R. S. Ives, Highwood, Ill.

It is stated that France's telegraph receipts during the Dreyfus trial were $120,000 more than for the corresponding month a year ago, while the receipts from telephones were $60,000 greater. The budget estimates from these two sources for that period were exceeded by over $340,000.

Ohio Electric Light Association.

The fifth annual meeting of the Ohio Electric Light association was held at Cleveland on October 10th and 11th, in the rooms of the Associated Technical Clubs. Though not as largely attended as it was expected it would have been, possibly by reason of the fact that the electric-light men are all very busy at home, the papers read and the interest manifested well repaid those who came. The following-named gentlemen were present:

E. H. McKnight, Bowling Green Electric-Light and Power company; H. C. Fogle, Canton Light, Heat and Power company; J. Q. Brown and J. M. Plaisted, Columbus Electric company;

FIG. 9. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—SUB-STATION AT WINNETKA.

A. W. Field, Columbus Edison Electric Light company; Samuel Scovil, C. B. Tripp, H. D. Whiton, F. N. Stone, M. E. Turner and S. C. D. Johns, Cleveland Electric Illuminating company; M. F. Raber and Reid Carpenter, Citizens' Electric Railway, Light and Power company; George Hayler, Jr., Electric Light and Power company, Van Wert, O.; A. F. Dickinson, Geneva Electric Lighting company; D. L. Gaskill and H. C. Ayers, Greenville Electric Light and Power company; Mr. Gorton, Jefferson Light and Power company, Warren; B. C. Faurot and J. E. Townsend, Lima Electric Light and Power company; J. C. Thullen, Leetonia Electric Light and Power company; S. Griffin, Lake Erie Electric Light and Power company, Lorain; B. P. Foster, Northern Gas and Electric company, Norwalk; J. H. Miller, Springfield Light and Power company; Emil G. Schmidt, Sandusky Electric Light company; W. S. Smith, Toledo Consolidated Electric company; C. E. Inman, Warren Electric Light and Power company; J. H. Perkins, Youngstown Electric Light company; Seymour C. Prentiss, Cleveland; Allen Ripley Foote, Takoma Park, D. C.; George M. Hoag, city electrician, Cleveland, O.; H. Whitford Jones, Electric Supply company, Cleveland; W. P. Ambos, Cleveland; T. E. Adams, Adams-Bagnall Electric company, Cleveland; T. H. Bailey Whipple, Buckeye Electric company, Cleveland; B. A. Stowe, Jandus Electric company, Cleveland; F. G. Colwell and H. B. Coles, General Incandescent Lamp company, Cleveland, O.; George C. Kuntz, Bedfield Belting company, Cleveland, O.; E. A. Wilson, Niles Electric company, Niles, O.; H. E. Adams, Illinois Electric company, Chicago; F. O. Rusling, Varney & McOuat, Indianapolis; H. Irwin Southwick, Warren Electric Light and Power company; W. D. Packard and Robert E. Gorton, New York and Ohio company, Warren, O.; W. F. Hayes and W. J. Hauley, General Electric company, Cincinnati; A. H. Friend, M. B. Austin & Co., Chicago; Mr. Hopkins, Erner & Hopkins, Columbus, O.

The proceedings on Tuesday morning, up to 11 o'clock, were of an executive character, being committee sessions. At that hour Mr. D. L. Gaskill of Greenville, in the absence of the president and vice-president, called the general session to order. Mr. E. P. Roberts, consulting engineer of Cleveland, read the first paper, on "Utilization of Exhaust Steam for Heating Purposes."

During the reading of Mr. Roberts' paper President Schmidt arrived and took the chair. New members received were the Citizens' Electric Light and Power company of Logan and the Wyoming Water, Heat and Power company.

Much regret was expressed at the death of Mr.

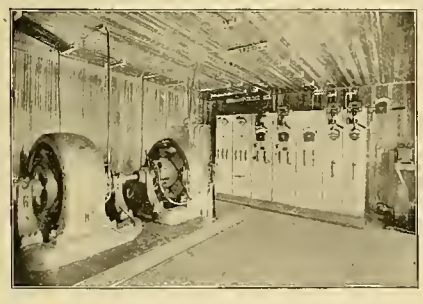


FIG. 11. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY — ROTARY CONVERTERS AND SWITCHBOARD AT WINNETKA SUB-STATION.

Bradner P. Holmes of the Youngstown Electric Light company, who, at the time of his death, last February, was vice-president of the association. Suitable resolutions, prepared by E. H. McKnight, J. Q. Brown and S. Griffin, were adopted at the afternoon session.

In his annual address President E. G. Schmidt of Sandusky spoke with feeling of the death of Mr. Holmes. He said that in the enclosed alternating-current arc lamps the central-station man had a new and improved weapon to fight the incandescent-gas burner. He spoke of the leakage in poor line construction, converters and lamps and doubted whether 10 per cent. of the stations in the state were equipped with wattmeters to measure their total output. He thought that all consumers should be placed on a meter basis; even though the gross output might decrease, the net income would be larger. Mr. Schmidt regretted that the membership was not growing very rapidly and recommended a change to midsummer in the time of meeting.

Mr. George Hayler, Jr., of the Van Wert Electric Light and Power company read a paper on "Suggestions to the Managers of Small Central Stations." It was the sense of the association that the suggestions were of great value to those to whom it was especially addressed, and many of its recommendations applied equally to larger plants. The essayist treated the subject exhaustively. After a discussion, he was followed by Mr. Leon Le Pontois, E. E., now of the Winton Motor Carriage company of Cleveland, who was brought from France to this country by Edison. His subject was the turbo-electric generator. Summing up the advantages of the steam turbine, he said, in part: "From the satisfactory test of the different types of steam turbine lately constructed, and possibly from the few remarks which I have had the honor of presenting to you, I think that we may well agree that the time is not far distant when our electric-light and power plants will undergo a great change. The high-speed, vibrating, pounding steam engine and the good, old faithful Corliss engine type itself will be relegated to the scrap-pile, and in their stead, in one-fourth of the space, on light foundations, will stand the compact structure of the turbo-electric generator, without belting and counter-shafting. The stationary engineer will have an easy time of it, while the station manager will find a great reduction in his coal-piles."

Wednesday's sessions opened with a largely increased attendance, and were presided over by Mr. Gaskill, President Schmidt being unexpectedly called home. Papers were read by Mr. M. E. Turner of Cleveland and by Mr. H. W. Hillman of Schenectady, the title of the former being "Street Lighting by Direct and Alternating Currents," and

FIG. 13. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—COMBINATION BAGGAGE AND PASSENGER CAR.

the latter "The Arc-lamp Department of Central-station Business." These two subjects being closely related in interest, were discussed together, and the morning was occupied entirely in their reading and the lively discussion following, in which Messrs. T. E. Adams, Hillman, Turner, Perkins, Scovil, Bagnall, Stowe, Faurot and Hoag participated.

The closing session of the meeting was held Wednesday afternoon, when, as the first order of business, a paper was read by H. G. Reist, E. E., of Schenectady, on "A New Compensated Revolving-field Alternator," which elicited some discussion.

The following-named officers were elected for the ensuing year: President, D. L. Gaskill, Greenville; vice-president, W. S. Smith, Toledo; secretary-treasurer, J. Q. Brown, Columbus; executive committee, Emil G. Schmidt, George Matt, E. H. McKnight; George Hayler, Jr., Van Wert; J. E. Townsend, Lima; advisory committee, Samuel Scovil, Cleveland; A. W. Field, Columbus; H. C. Fogle, Canton; finance commitee, A. F. Dickinson, Geneva; W. F. Raber, Mansfield; J. H. Perkins, Youngstown.

Toledo was selected as the next meeting place.

The sense of the convention was declared in favor of an earlier date for annual meetings hereafter, October being considered too busy a season. A resolution to take the sense of the members on this matter of date through correspondence from the executive committee was adopted.

Omaha-Council Bluffs Railway.

The Omaha, Council Bluffs and Suburban Railway company is pushing work on the construction of its grade between the East Omaha terminal bridge and its line in Council Bluffs. The line will be approximately 20 miles long, the route being from Lake Manawa through Council Bluffs to East Omaha over the drawbridge; thence west to the city limits of Omaha, using the Omaha Street Railway company's tracks to Sixteenth and Harney streets. The company's offices will be located in a fine office building, which will be erected at Sixteenth and Harney streets in the spring.

Plans have been prepared by the company's architects, Fisher & Lawrie, for a car barn and power house in East Omaha. The buildings will be of brick. The power house will contain a generating plant, up-to-date and modern in every detail. The motor cars will be of the latest pattern, weighing about 36,000 pounds and equipped with four motors, aggregating about 150 horse power. The company expects to have the line in operation by the middle of May.

Need of Electric Railways in India.

In a recent report Mr. W. T. Fee, the United States consul at Bombay, gives some interesting facts about the horse-railway system of the Bombay Tramway company. The stock of the company is

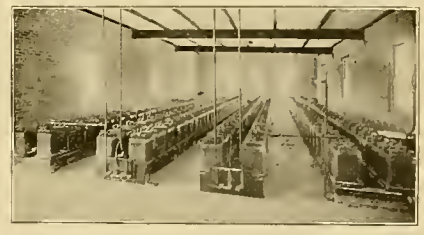


FIG. 12. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—BATTERY ROOM AT WINNETKA SUB-STATION.

principally owned in the United States and the main office is located in New York. About 1,100 men and 1,150 horses are employed for a double-track system of 17½ miles. The drivers and conductors are paid by the trip, and the former receive about 18 rupees ($5.85) and the latter 22 rupees ($7.15) a month. The track, barn and common laborers receive the usual Bombay wages of six annas (12 cents) a day.

There is now a movement to convert the road into an electric line. In fact, the company has applied to the Bombay government to sanction the conversion. Electricity has but recently come into use in India, Madras being the only city where it is used on street railways as a motive power.

The rents in the city of Bombay are extremely high. Bungalows rent from $800 to $2,000 a year, and flats without any modern conveniences for from $500 to $1,000 per annum. The population of the city in the last census in 1891 was 821,764. The density of population in certain parts of the city is very great. In the native quarters, which contain most of the population, it is estimated that there is one human being to every 10 square yards of space. The mortality at present is great, owing largely to the plague with which the city has been infected for the last three years.

"In view of these facts," says the consul, "it is hoped that the Bombay government will speedily sanction the conversion of the present system of street-car road into an electric line, and that the company will not only extend its service to all parts of the city, but also to outlying and suburban districts, and give the people of this city a service of cheap and rapid transit, thereby providing an out-

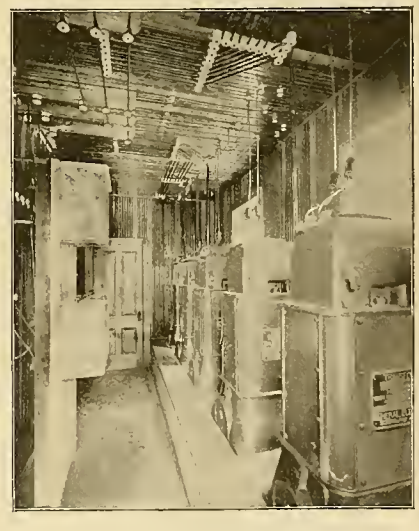


FIG. 10. CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—STATIONARY TRANSFORMERS AT WINNETKA SUB-STATION.

let, as in many large cities of Europe and America, for its overcrowded quarters, and being of advantage not only financially, but also from a sanitary standpoint."

The city of Oconto, Wis., has accepted the proposition of the Holt Lumber company for 35 arc lights, of 2,000 candle power, at $2,800 per annum for three years.

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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The recent illumination of State street in Chicago, on the occasion of the Fall Festival, showed very decidedly the advantages of electric over gas lighting for purely decorative purposes. For some reason gas flambeaux on the rostral columns were made a part of the lighting scheme, while incandescent lamps were used for the festoons of light above and in the private decorations on the buildings. It is no prejudice to say that the gas illumination suffered by the comparison. The burners were incongruous and inartistic; the light itself was yellow, smoky and unsteady. The jets were unenclosed, and the smoke was a very decided objection, as it soon made the handsome white columns grimy and detracted from their beauty. Then, too, the incandescent lamps had the advantage of easily obtained color effects. Altogether, the superiority of the electric light, for this particular purpose, was conspicuous.

Several states have street-railway associations, but has any state but Ohio an effective organization of electric-light men? There are associations taking in groups of states, like the Northwestern and the Southwestern, but we do not recall any active organization of electric-light men exclusively, in a single state save that in Ohio, which held its annual meeting last week. Mr. Schmidt, the retiring president, complained that the membership was not growing very rapidly; but the association is still lively and vigorous and listened to the reading of several instructive papers. The organization is helpful to its members, and in these days of municipal-ownership discussion and of actual and possible legislation peculiarly affecting the electric-lighting interests it is rather curious that Ohio stands in its unique and honorable position of pre-eminence.

Pennsylvania, New York and Illinois have each more central stations than Ohio, but their electrical men seem somewhat backward in coming forward, although in each of the states named there is a street-railway association.

Much space in this issue of the Western Electrician is devoted to street-railway affairs in Chicago and to the meeting of the American Street Railway association in this city. Writing on the eve of the convention, it seems to be apparent that it will be a conspicuous and successful gathering in numbers, influence and work accomplished. Nearly every street-railway company in the country is doing a good business, sharing in the general prosperity evident in all branches of industry, and thus the members of the association meet under pleasing conditions to discuss matters of mutual interest.

The association has not met in Chicago since 1883, when it was but one year old. Of the tremendous changes that have been brought about since then in methods of street-railway service it would be superfluous to speak. With the single exception of conduit electric railways, visitors to the convention can see in Chicago and its environs about every system of urban and suburban traction now in use—cable roads, elevated and surface electric lines, trolley-wire and third-rail contacts, accumulator cars, high-tension alternating current transmitted to sub-stations, multiple-unit and locomotive systems of electric train operation, and a few compressed-air and horse cars. This is a varied list, and it should afford some instruction to those who have time and inclination to seek it.

In the arrangement of the programme this year much wisdom has been displayed. There are but five papers, but they are all from men of prominence and experience in some branch of the street-railway industry. No more than two papers are set down for any one day, so there should be ample time, aside from transacting the business of the association, to read every paper and to discuss it intelligently. In all gatherings of this character free discussion of the ideas advanced in the papers is a most valuable and fruitful feature, and it is a mistake to overload the programme to the extent that some of the papers are barely read and not discussed or perhaps read by title only. Members should consider it incumbent upon them to make the discussions valuable by giving of their experience or by seeking information. Often a single question will bring about a valuable interchange of ideas of benefit to all.

It is always a pleasure to recognize the cordial relations that have long existed between the American Street Railway association and the "supply men"—the manufacturers and dealers who appear at the conventions, many of them with exhibits, and contribute so much to the brilliancy and success of the meetings. This year, by formal vote of the executive committee, Friday is especially set apart as "supply men's day." The association will hold no formal session on that day and there will be no "social features," except those arranged exclusively for the ladies; the entire day is given to the examination of exhibits. "Let us show our appreciation of the efforts of the supply men," say the officers of the association, "by examining what they have to show us. It will be beneficial to all." This is the correct attitude to take toward the business side of the association; it strengthens the association materially and helps the dealers.

In every way the Chicago convention promises to be instructive and satisfactory.

It is of particular interest, just at this time, to note that the "international tramways and light railways exhibition," to be held at the Royal Agricultural Hall, Islington, London, from June 30th to July 11th, next year, is planned on much the same scale as the annual exhibitions of the American Street Railway association. "The experience of the American Street Railway association is conclusive as to the value of such an exhibition, not only to manufacturers and dealers, but to the tramway industry at large," say the promoters of the proposed English show. However, this is to be an international exhibition of wide scope, including track construction, power-station equipment, rolling stock, electric and cable-car equipments, steam motor cars, trucks, brakes, and, in fact, all kinds of apparatus designed for street-railway service, including compressed-air, gas, steam and electric systems. The exhibition has been arranged with the object of enabling municipal and other local authorities, street-railway men and the general public to examine the latest apparatus designed for the equipment of street and light railways, both surface and underground. "It is well known," in the language of the prospectus, "that very wide experience has been obtained both upon the continent of Europe and in America in providing local traveling facilities, and it is one of the purposes of this exhibition to give local authorities and tramway officials in the United Kingdom an opportunity to acquire familiarity with apparatus that has been introduced abroad as well as in this country. Both home, colonial and foreign manufacturers and inventors are invited to exhibit."

As is generally known, Great Britain is seeing a great light just now, by which it observes that its tramway facilities are antiquated and inadequate. New street railways or the rebuilding of existing lines, to provide the facilities greatly needed, are discussed in every large town in the United Kingdom. The situation resembles the state of affairs in this country ten years ago, with the difference that whereas we were pioneers and had to evolve the electric-railway system from a theory by the actual test of arduous experience, our transatlantic friends are taking to the art when it is well developed and a conspicuous success. The early efforts were crude and often laughed at. Everyone remembers the experience of Mr. Sprague in Richmond. The first car became stalled and couldn't be budged by any manipulation of the current. The inventor deliberated and then sagely announced that he would send for his instruments and remedy the difficulty. When the "instruments" arrived they proved to be a pair of sturdy mules and they pulled the car back to the barns ingloriously. But these early difficulties were indispensable and invaluable. They made possible the service we enjoy to-day. The United States has now the best and most widely extended street-railway facilities of any country in the world. American manufacturers are cordially invited to exhibit at the exhibition that has been planned for London, and no doubt many of them will embrace the opportunity. The show has been arranged by the proprietors of the Tramway and Railway World of London, and has a long list of right honorable and right worshipful mayors and other dignitaries as patrons. A representative of the journal named is attending the convention here, and he will no doubt book many applications for space.

Northwestern Elevated Railroad.

Construction work on the elevated structure for the Northwestern Elevated railroad, now building in Chicago, is going forward with but few delays at present, and if no serious obstacles arise it is planned to have the road in operation by March, 1900. The line will run nearly north from the center of the city, approximately paralleling the shore of Lake Michigan, although some distance away from it. Its northern terminus will be at Wilson avenue (west of Evanston avenue), and it will join the Union Loop at Lake street and Fifth avenue. When completed there will be a double track from Lake street to Institute place, a distance of .92 mile, and four tracks from that point to the end of the line, a distance of 5.52 miles. This will make the total length of the road 6.44 miles.

In addition to the main tracks there will be 1.31 miles of single track and .21 mile of double track to be used for storage, the whole constituting 25.65 miles of single track, of which 23.92 miles will be operated for regular railway traffic. About 13 miles of the track is completely finished and considerably more than half of the steel structure is erected. The company owns its own right-of-way north of Chicago avenue.

Express trains will be operated on the road, using the two middle tracks of the four-track road, while the local trains will run on the outer tracks. A section of the four-track construction, as now completed near Lincoln avenue, is shown in Fig. 1.

Trains will be pulled by electrically operated motor cars, the system being similar to that now used on the Metropolitan and Lake Street elevated roads in Chicago.

The power house is located on Fullerton avenue, near Southport avenue, 3,000 feet west of the elevated structure and about equidistant from the ends of the line. It is a brick building with basement, 112 feet wide and 255 feet in length, and is now practically completed. An exterior view of the building is shown in Fig. 2. A brick wall divides the building longitudinally into a boiler room 50 feet wide and an engine room 58 feet wide. A 203-foot octagonal brick stack with 16-foot flue rises from the rear end of the boiler room. As built the building is planned for an engine capacity of 7,000 horse power, but the position and capacity of the stack will allow of an extension to the building which will give the whole plant an ultimate capacity of 14,000 horse power.

In the boiler room there will be installed 12 Babcock & Wilcox water-tube boilers, set in batteries of two each, and equipped with Murphy automatic smokeless furnaces and provided with coal and ash conveyors. In the basement under the boiler room

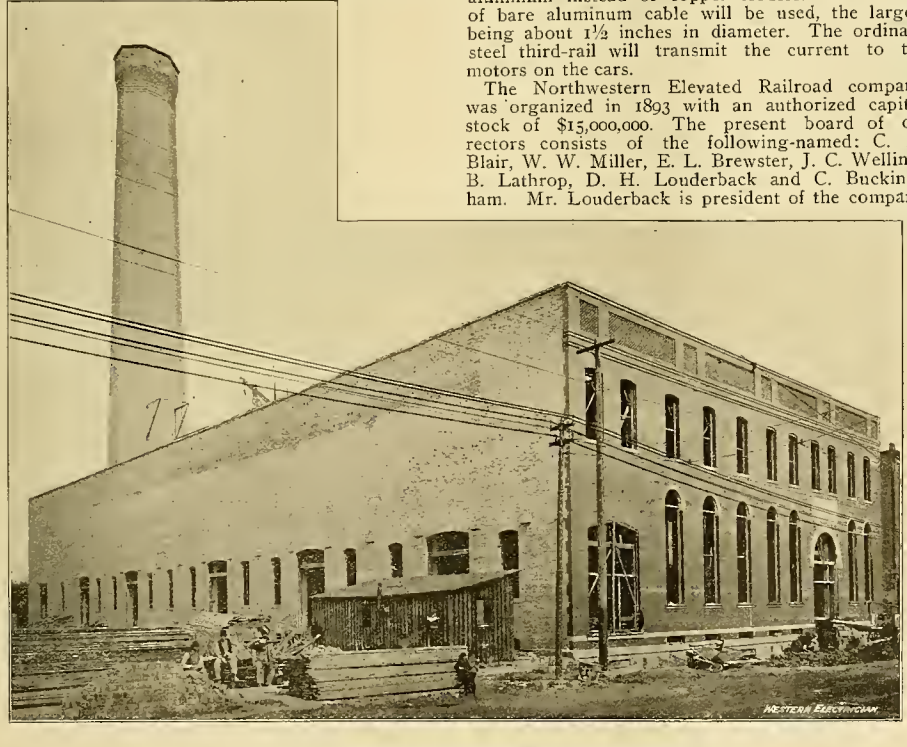


FIG. 2. NORTHWESTERN ELEVATED RAILROAD.—POWER HOUSE.

will be located the smoke flues, boiler feed pumps and the entire system of feed and blow-off piping, ash conveyors, etc.

The engine room will contain three direct-connected engine and generator units of 1,500 kilowatts capacity each and one of 750 kilowatts. Three 2,000 horse power and one 1,000 horse power cross-compound, slow-speed, condensing engines of the Allis-Corliss type will be used. The cylinders of the larger engines will be 30 by 60 by 60 inches in size, while the smaller one will have corresponding dimensions of 23 by 46 by 48 inches. These engines will drive Siemens & Halske 550-volt internal-armature generators. The larger units will have a speed of 75 revolutions a minute and the smaller one 80 revolutions. A switchboard of the General Electric company's standard railway type will be installed with the generator panels on the main floor and the feeder panels on a gallery. The engine-room basement will contain all steam and exhaust pipes, separators, receivers and the electric cables running to and from the switchboard.

Coal will be taken from a side track of the Chicago, Milwaukee and St. Paul railroad, and condensing water will be obtained from a 12-foot brick tunnel in Fullerton avenue that was erected by the city to convey water from Lake Michigan to the North Branch of the Chicago River for flushing purposes. The steam from all the engines will be condensed in a central condenser of the Weiss counter-current type.

An interesting part of the electrical equipment of the Northwestern Elevated will be the use of aluminum instead of copper feeders. Three sizes of bare aluminum cable will be used, the largest being about 1½ inches in diameter. The ordinary steel third-rail will transmit the current to the motors on the cars.

The Northwestern Elevated Railroad company was organized in 1893 with an authorized capital stock of $15,000,000. The present board of directors consists of the following-named: C. L. Blair, W. W. Miller, E. L. Brewster, J. C. Welling, B. Lathrop, D. H. Louderback and C. Buckingham. Mr. Louderback is president of the company and Mr. Brewster is the vice-president. Other officers are: Secretary and treasurer, Howard Abel; chief engineer, C. V. Weston; electrical engineer, J. R. Chapman.

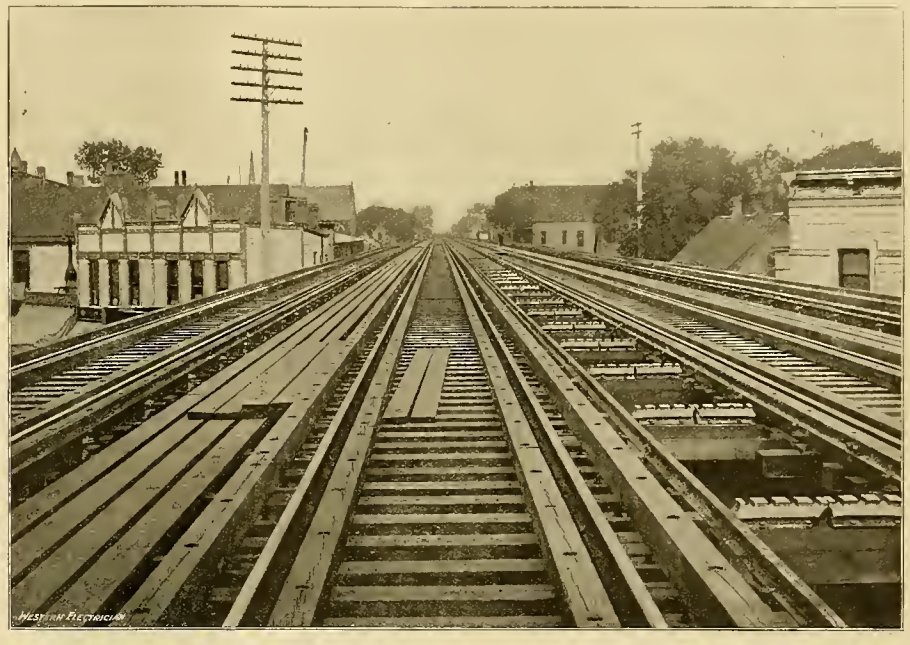


FIG. 1 NORTHWESTERN ELEVATED RAILROAD.—FOUR-TRACK STRUCTURE, SHOWING CONTACT RAILS AND FEEDER BLOCKS.

The Nevada Power company has been organized at Reno, Nev. It proposes to transmit power from the cañon east of Reno to the Comstock for pumping and other operations, as well as to distribute power to Reno and vicinity. The cañon is 11 miles nearer to the Comstock than is Floriston, the point from which a similar plan has been proposed. The company is capitalized for half a million and is said to be backed by eastern capitalists.

Franklin Institute Anniversary.

The seventy-fifth anniversary of the Franklin Institute of Philadelphia was commemorated at the National Export Exposition from October 2d to 7th inclusive. The second meeting was held on Tuesday evening under the auspices of the electrical section of the Institute, with Professor George A. Hoadley, president of the section, presiding. Dr. Edwin J. Houston made an address on "The Seventy-fifth Anniversary of the Franklin Institute from an Electrical Standpoint." After giving briefly the early history of electrical discoveries, Dr. Houston spoke in detail concerning the aid given pure and applied electric science by the Franklin Institute. He referred to the International Electrical Exhibition of 1884, which was limited strictly to the examination of electrical devices and appliances and which, he said, was held at the suggestion of the electrical section of the Institute. An address on "The Influence of Technical Societies in Promoting the Progress of the Arts" was delivered by Ralph W. Pope of New York, the secretary of the American Institute of Electrical Engineers. Mr. Pope spoke of the advances made in every branch of science during the last 75 years and reviewed the contributions and work of the Institute in scientific fields since its birth. He called attention to the necessity of thoroughly training students at an early age in elementary physics, stating that the prevailing ignorance of the simplest scientific facts was responsible for the existence of a class of alleged inventors who devise schemes for obtaining money under false pretenses.

Development of Chats Falls.

One of the biggest deals ever undertaken by Ottawa (Ont.) capitalists was consummated a few days ago when the Chats Falls, at Quyon, in the province of Quebec, passed into the control of the Pontiac Mining company. The enormous amount of 680,000 horse power can be developed at the falls, and it is understood that the company will take steps to secure the location of industries of various kinds and of large size. These falls are about 35 miles from Ottawa. The purchase was carried through by Messrs T. C. Bate, president; N. A. Belcourt, M. P., J. W. Poupore, M. P., P. Clark, secretary-treasurer, all of Ottawa; Denis Ryan, managing director, of St. Paul, Minn., and ex-Senator T. A. Darby of North Carolina. These gentlemen bought the property as individuals, and are turning it over to the company at exactly the same figure as they paid for it. The company owns the property outright, and the directors are among the leading men of Ottawa. The capital stock is $490,000. It is confidently expected that the district about Chats Falls will witness as great electrical development as that about the Chaudiere Falls in Ottawa.

Additions to Alley "L" Power House.

The South Side elevated railroad, or what is popularly known as the Alley "L," is doubling the capacity of its power house at Fortieth and State streets. The plant now consists of four direct-connected engine-generator units, giving a total output of 5,000 horse power, which can be increased to 8,000 horse power by lengthening the cut-off of the engines. In increasing the capacity of the plant the same style of engines and dynamos will be used. These will consist of two 2,500 horse power cross-compound engines of the Allis-Corliss type and two 1,500-kilowatt Westinghouse generators.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The People's Telephone company of West Superior, Wis., is preparing a reorganization to bring the company entirely under local management, as was done by the Zenith Telephone company, across the bay, in Duluth.

The American Telegraph and Telephone company has completed a telephone connection between West Superior, Wis., and Minneapolis and St. Paul. Duluth is not on the line, for the reason that the company was refused a franchise such as it demanded.

The Mississippi Valley Telephone company now has about 1,400 instruments connected and working in Minneapolis, and is adding to the number all the time.

The Wisconsin Telephone company has agents at work among the telephone users at Eau Claire and Chippewa Falls, Wis., showing the company's side of the raise in rates.

Ex-Congressman H. E. Boen of Fergus Falls, Minn., advocates public telephone systems by townships, through his paper. He would have them maintained the same as roads and bridges.

The Village Council of Hallock. Minn., is putting in a telephone system.

The Prairie Queen Telephone company of Cambridge, Wis., has completed a line to Deerfield, Wis.

The Wisconsin Telephone company will rebuild the entire system at Washburn, Wis.

It is understood the Northwestern Telephone Exchange company will string a third wire for the system between Albert Lea, Minn., and Minneapolis.

The Interstate Telephone company has just installed a local exchange at Appleton, Wis.

The Beloit (Wis.) Telephone company will connect with 10 or more small public stations in the vicinity.

A stock of telephone supplies in the rear of the telephone building in St. Paul caught fire and for a time endangered the building. The flames were soon brought under control.

Work is being hurried on the new telephone exchange at Delavan, Wis., and it is expected to be in operation the first week in November.

The Wisconsin Telephone company, at Clinton, Wis., has completed work on the connections with that place.

The Central Telephone company of Mayville, N. D., has been organized with $5,000 capital stock. The company will build a line between Hillsboro and Mayville.

The Standard Telephone company proposes to extend its toll lines from Cresco, Ia., to Le Roy, Minn., where a local exchange is to be installed.

Mr. Cliff proposes to establish a local telephone exchange in Clinton, Minn.

The Oelwein (Ia.) Telephone company has completed lines to Fayette, Randalia and West Union.

The Cedar Valley Telephone company has filed a trust-deed for $24,000 at Waterloo, Ia., in favor of Ralph Van Vechten of Cedar Rapids, Ia. It covers notes for the same amount.

Sioux Rapids, Ia., has connection with Spencer, Ia.

C. B. Miller is the promoter of a telephone line from Clinton. Ia., to Maquoketa, Ia.

The Iowa Telephone company is building a line from Wilton to Tipton, Ia.

The council of Davenport, Ia., is considering a franchise for 25 years for the Iowa Telephone company. The company agrees to put in an underground-conduit system, to cost $70,000, and erect its own buildings, at a cost of $80,000.

The County Telephone and Telegraph company, which was recently incorporated at Waterloo, Ia., proposes to connect the Independent systems of Iowa by copper-metallic circuits.

The Iowa Telephone company will rebuild its system at Iowa City, Ia.. at once.

The Iowa Telephone company has installed 25 instruments at Ida Grove, Ia., for private use. A metallic circuit through the town will soon be connected with Sioux City.

The Northern Telephone company of Fonda, Ia., has completed a toll line to Newell, Ia.

The Michigan Telephone company will make a number of changes and improvements to its system in Menominee, Mich., putting in new cables and switchboards at a cost of $16,000.

The Sunset Telephone company of Tacoma, Wash., finds a constant demand for connection with the city from the small towns in the vicinity, five to 10 miles distant.

The Citizens' Telephone company of Faribault, Minn., has installed a new switchboard of 300 calls.

Brule, Wis., now has long-distance connection.

Sanborn, Ia.. voted to grant a franchise for a telephone exchange. There are several applicants.

The Iowa Telephone company is building a line from Richmond, Ia., to Washington, Ia.

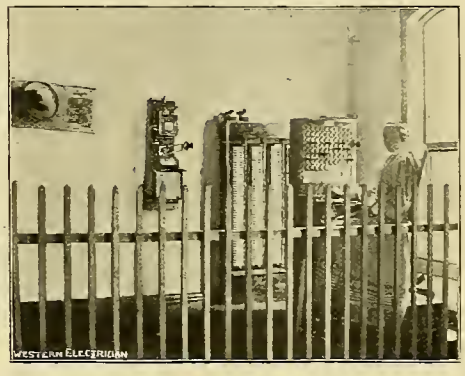
A telephone exchange is being installed at Wapello, Ia.

The Southern Bell Telephone company is putting its wires underground in the principal business streets of Columbus, Ga.

Humboldt Telephone Exchange.

As has been frequently remarked, one of the most beneficent results of the Independent telephone movement has been the placing of telephone service at the disposal of the residents of small villages and farming communities which had been ignored by the high-and-mighty Bell companies.

In Humboldt, Neb., the Humboldt Telephone company was organized a little over a year ago to build and operate a telephone exchange. The officers were: President, E. A. Tucker; vice-president, O. A. Cooper; secretary, F. R. Butterfield; treasurer, A. H. Fellen. The enterprise was not a very large one, but the company started ont with the idea of using good material and giving good service. By following this plan it made a good investment. An exchange was established, using the metallic-circuit express switchboard and the instruments of the American Electric Telephone company of Chicago. F. H. Whitaker of Topeka, Kan., superintended the construction of the plant, in which full metallic circuits are used. There is a lightning arrester over each telephone as well as a full set at the switchboard. At the beginning there were 70 subscribers; now there are 106, and a second section of switchboard has been ordered. The debt



HUMBOLDT TELEPHONE EXCHANGE.

contracted at the opening of the exchange has been paid and the plant is clear.

The company extended its lines to the edge of town and there met the connecting lines of farmers in the surrounding country. Some of the farmers use the barb-wire fences for conductors; others have pole lines. Humboldt has now telephone toll-line connection with every other town in the county and also with the Interstate company of St. Joseph, Mo. It has experienced a decided benefit from the little Independent telephone company whose modest exchange outfit is shown in the picture.

Atlanta Standard Telephone Company.

The Atlanta Standard Telephone company (Independent) has opened its exchange on Edgewood avenue in that city and is giving unlimited service to nearly 1,000 subscribers, the rates being $36 and $24 a year for business houses and residences respectively. None but metallic circuits are used, and the construction is said to be first-class throughout. Experienced switchboard operators are employed and a resting room is provided for the use of the girls. The construction was done by the Southern Standard Telephone Construction company, under the personal supervision of Manager H. A. Douglass, an expert in such work, from Chicago, and more recently of Grand Rapids, Mich.

TELEPHONY ABROAD.

Owing to the increase of telephonic traffic between Berlin and various places in Denmark, a new line will shortly be opened. Telephonic connection is now being established between Berlin and Warnemünde, whence a telegraph cable runs to Gjedser.

A large extension of the trunk telephone system will probably take place in France. In answer to a proposal of the Administration of Posts and Telegraphs, 80 of the 86 departments have expressed themselves in favor of telephonic connection between one another and Paris. It is said that $6,000,000 will be spent on new lines.

At a recent meeting of the Liverpool Chamber of Commerce it was reported that the postmaster-general had informed the chamber that negotiations were proceeding with the French Administration of Posts and Telegraphs with regard to tariffs and other conditions, and that no difficulty was apprehended in eventually establishing telephonic communication between Liverpool and Paris.

The telephone administration of the German government has been backward in adopting improvements likely to benefit its subscribers, but the Bavarian telephone department is attempting better things. A new exchange has been opened at Munich, in which lamp-signal switchboards are employed, and the so-called "calculograph" has at the same time been introduced for timing conversations.

Rock Island to Have a New Company.

As has been already stated in the Western Electrician, the business men of Rock Island, Ill., are greatly dissatisfied with the service and rates of the Central Union Telephone company. The Rock Island Club is active in the campaign, and some time ago appointed a committee to discuss the situation with the Central Union people. The company proposed a new schedule of rates, but on the question of giving rebates for defective service, it took the ground that it could not discuss with a committee the "alleged grievances" of individuals. This was not satisfactory to the club, and at a meeting held last week the whole subject was gone over, and, after listening to the statements of telephone men who were present, it was decided to organize a mutual company to compete with the existing monopoly. This is the language of the resolution that was adopted:

Resolved, That it is the sense of this meeting that the offer of the Central Union Telephone Company is unsatisfactory, and that the committee be continued and authorized to enlist the services of the best talent that they can obtain to organize a subscribers' telephone company, and we pledge such company our unanimous support.

Federal Telephone Company.

The Federal Telephone company, with an authoried capital of $10,000,000, was incorporated at Trenton, N. J., on October 13th. The company is authorized to do a general telephone and telegraph business. The incorporators are F. W. Garvin, J. S. Garvin and C. F. Smith, all of East Orange, N. J., who are said to be simply associates of Mr. J. B. Dill, the counsel for the new company. It is said that the company is organized to effect long-distance connection between the Independent companies in the large western cities; that the new Illinois Telephone and Telegraph company of Chicago is interested in it and that by an unusual provision in the incorporation papers the control of the company cannot be secured by the Bell people.

Meters for Telephone Use.

Telephones with meters attached are to be introdnced by the Chicago Telephone company if its patrons wish. The new instrument is regarded as something of an experiment, although it has been in use in New York city for a short time. The meter attachment registers the number of outgoing calls. When a subscriber desires to use his telephone he asks Central for the number, and as soon as he hears the "hello" of the person he is calling he pushes a black button immediately above the transmitter, which operates a counting machine. Until he pushes this button he cannot make himself heard at the other end of the line.

A Long Telephone Circuit.

The Rocky Mountain Bell Telephone company has completed connection between Butte, Mont., and Salt Lake, Utah, 434 miles apart by wire. Connection is now possible from Salt Lake to San Francisco, via Butte, the longest telephone circuit in the world, it is said, being 2,200 miles. The toll rates are, from Butte to San Francisco, $17 for five minutes' talk, and from Salt Lake $4 more.

NEW COMPANIES.

The Piatt County Telephone company of Monticello, Ill., has been incorporated. The authorized capital is $5,000, and the incorporators are William F. Ledge, William E. Ledge and James O. Snyder.

The Springfield (Ill.) Mutual Telephone and Telegraph company was incorporated on October 11th in the office of the secretary of state. Thomas Wilson, Simon M. Rogers and J. M. Wilson, all of Springfield, are incorporators. The company's capital stock is $50,000. The company was given a franchise by the City Council of Springfield about two months ago. It is stated that the company will begin at once to erect poles and lines, and it hopes to have the new system in operation within a few months.

MANUFACTURERS AND DEALERS.

The Victor Telephone Manufacturing company of Chicago entered the Independent telephone-manufacturing field about 18 months ago and has built up a large business. The high efficiency and sterling quality of the products, it is asserted, have placed the Victor company in the front rank of telephone manufacturers. The company has found it necessary to secure larger quarters to handle its growing business. The new home of the company is located at 203-207 South Canal street. Its new quarters give the Victor company one of the finest equipped and best-appointed telephone manufactories in the country. All these improvements have been rapidly brought forward under the management of the president of the company, Mr. William T. Blaine, who has secured as associates in the conduct of the company's business Messrs. H. C. Dodge and H. B. McNeal, who are well known in the Independent telephone field.

New Speer Carbon Company.

When, last spring, that organization so familiarly known to the electrical trade as the "carbon trust" succeeded in gathering in, so to speak, nearly every manufacturer of both lighting carbons and carbon brushes, it looked, indeed, even to the most conservative, as though the carbon industry was monopolized. Among the concerns absorbed was the Partridge Carbon company of Sandusky, O. It will, therefore, be of great interest to the electrical fraternity in general and the electric street-railway companies and other users of carbon brushes to know that there is now "another Richmond in the field" in the person of the organizer of the late Partridge Carbon company.

Factory at St. Marys.

Andrew Kaul, President.

Andrew Kaul, Jr., Secretary.

NEW SPEER CARBON COMPANY.

When the control of the Partridge Carbon company was purchased by the Cleveland organization, the former company's secretary and treasurer, J. S. Speer, was left in no wise interested in the new regime. For a time Mr. Speer, who, it may be stated, is thoroughly conversant in the manufacture of carbon products of all kinds, was undecided as to the field into which it would be best to direct his energies. After casting about for some time for the best investment, and realizing that the prospects for a continued prosperity in almost every line of business were most excellent, and having received tempting overtures from several influential capitalists, he finally concluded again to enter the carbon business. While this move will be a surprise to the general trade and a majority of Mr. Speer's friends, it would seem to be a wise step, as it is safe to say his long experience and intimate technical knowledge of the carbon business eminently fit him to preside over the large and complete property that has been erected at St. Marys, Pa., and will be operated from now on under his management.

J. S. SPEER.

Several months ago Mr. Lewis Streuber, one of the pioneers of Erie, Pa., a capitalist and one of the owners of the Merchants and Manufacturers Electric Light, Heat and Power company of Erie, Pa., approached Mr. Speer with the idea of organizing a carbon manufacturing company, which now has its plant at St. Marys, Pa., and the result was the formation of the Speer Carbon company, with the following-named gentlemen as officers, directors and stockholders: Andrew Kaul, president; Lewis Streuber, vice-president; Andrew Kaul, Jr., secretary and treasurer; B. E. Cartwright, director; J. S. Speer, general manager; J. G. Wertz, stockholder.

As a matter of general interest, a word may be said relative to the financial and general business standing of the gentlemen backing this enterprise. President Andrew Kaul is one of the most prominent capitalists and promoters of the section around St. Marys. Mr. Kaul, too, is one of the old pioneers and is now one of the largest lumber dealers of that section. It would be doing him an injustice as a capitalist not to mention the interesting fact that his name can be found in a list, recently published by a prominent New York paper, as one of the millionaires of the United States. Secretary and Treasurer Andrew Kaul, Jr., is a true "chip of the old block," and with him as financial executive of the new company, it is safe to say that this department of the Speer Carbon company will be most efficiently organized and skillfully handled. Vice-president Lewis Streuber, in addition to his interest in the Merchants and Manufacturers Electric Light, Heat and Power company of Erie, Pa., is largely engaged in the fish business and owns considerable stock in a number of lake vessels. Director B. E. Cartwright is known throughout the country tributary to St. Marys as one of the most energetic men in that section. He is general manager of the Pittsburg, Shawmut and Northern Railroad company. In addition to the above-named gentlemen, J. G. Wertz, a capitalist of Pittsburg, Pa., one of the former stockholders of the old Partridge Carbon company, is also interested in the new Speer Carbon company. Mr. Wertz is prominently engaged in the hair felt manufacturing business in the neighborhood of Pittsburg.

Besides the executive staff as above named, Mr. Speer has secured the services of M. H. Kelley, who, for so long, was the "right-hand man" to the management of the Solar Carbon and Manufacturing company of Pittsburg, which likewise was absorbed. Mr. Kelley is well fitted as an assistant to Mr. Speer, as his knowledge of carbon credits and other details of the business will stand him in good stead in his new position.

A word relative to the career of the general manager of the company will be timely. J. S. Speer first saw the light of day, spent his boyhood and was educated in Pittsburg, Pa. Early developing a taste for chemistry, he finally was graduated as chemist and pharmacist and started in the drug business in Pittsburg in 1876. The year 1880, however, found him seeking his fortune in the same business in Leadville, Colo. After three years' energetic work as a pharmacist in that locality and two years' employment at the same business in Dakota, he returned to Pittsburg. In 1890 Mr. Speer saw an opportunity in the electrical business, and realizing its great future, he organized the Partridge Carbon company and acted as its secretary and treasurer until the concern became a part of the carbon combination. It will thus be seen that Mr. Speer's training and experience in the manufacture of carbon has been of a very practical nature. The high reputation of the product that issued from the Sandusky factory was well known, and it is Mr. Speer's purpose to improve upon this in many respects. A visit to the Speer factory at St. Marys shows a thoughtfulness in the matter of laying out the plant and arranging every detail of manufacture that promises well for the production of a carbon brush strictly first-class in every particular.

During a recent visit to St. Marys a representative of the Western Electrician inspected the new plant. The factory as laid out by Mr. Speer is located on high ground, within a five minutes' walk of the center of the town of St. Marys, with connections with the Pennsylvania railroad.

The building, as shown in the picture, which is a reproduction of a picture taken from a point overlooking the factory and the railroad, covers an area of 195 feet by 95 feet, with ten acres or more of ground surrounding it, thus leaving abundant room for possible extensions. Without going into detail, it may be said that the building is of brick and most substantially laid out in every respect. In fact, it may be said that the projectors propose to make this factory in every respect one of the most modern in the field.

St. Marys, the point at which the new carbon company has seen fit to locate its plant, is one of the most thriving towns in Northwestern Pennsylvania. It is located at the junction of the Pennsylvania railroad and the Pittsburg, Shawmut and Northern railroad. It is in the center of the natural-gas country, with a supply practically unlimited. This advantage of a full supply of natural gas was one of the strongest factors in determining the projectors as to the advisability of locating the new carbon factory at St. Marys. The town also lies in the bituminous coal belt of Pennsylvania and is the seat of several thriving industries.

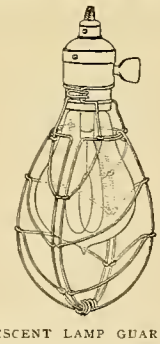
The Perturbation of Newton Nichols.

[From the Detroit correspondent of the Western Electrician.]

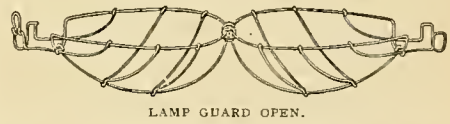
The surveyors on the Detroit and Northwestern electric line encountered curious opposition between the Grand River road and West Bloomfield. Newton Nichols and his family are the only occupants on a three-and-one-half mile stretch. It was necessary for the road to have 12 feet of this land. Nichols objected. He states that his son Frank is 37 years old, married, and has one child; that Frank never rode on a steam railroad in his life and still sleeps in the room where he was born. Newton Nichols is 60 years of age, and only once did he ride on a railroad—from Detroit to Lansing. He was almost scared to death and came back on a stage.

Incandescent Lamp Guard.

The accompanying illustrations show two views of the Century incandescent-lamp guard, manufactured by the William Inglis Wire and Iron Works of Detroit. In getting up this guard it has been the aim of the manufacturers to facilitate and lessen the cost of handling this line of goods. As shown in the cuts the guards are made to nest or pack one inside another—thereby, it is said, requiring about one-half of the shelf or store room needed by other guards now on the market. The guards are made with excellent socket fastenings, and when attached to the sockets are held firmly at a proper distance from the lamps to protect them when subjected to breakage. They are made with bright-tinned wire, silver finish, are neat in appearance and do not intercept the light. The firm manufactures other styles of incandescent-lamp guards, brass and copper globe nets, fan-motor guards and other wire specialties. A catalogue and a price-list of these goods are issued by the company.



INCANDESCENT LAMP GUARD CLOSED.



LAMP GUARD OPEN.

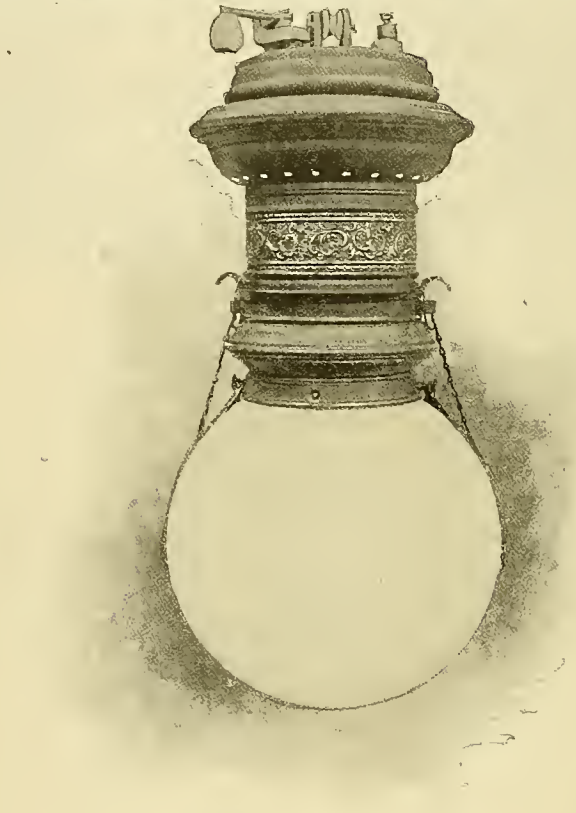
G. I. Alternating-current Arc Lamp.

After carefully considering requirements of the market in reference to enclosed arc lamps, the General Incandescent Arc Light company has come to the following conclusions:

That the demand is for an alternating-current, constant-potential lamp that will operate on any frequency from 50 cycles to 133 cycles. When operating on any number of cycles between the above numbers the lamps should be provided with an adjustment which would maintain the arc voltage at about 75 to 80, with a line potential from 95 to 125 volts. The lamp should be provided with a plain shell or cover of graceful design. The cover should be so constructed that the lamp will be adapted for indoor or outdoor service, and it should be so designed that either outer globe or reflector shade can be applied to the lamp without the slightest change in the cover or other parts.

With the above ideals in mind, the General Incandescent Arc Light company has now brought out its new G. I. alternating-current lamp.

In designing the G. I. alternating-current lamp great care has been taken to produce a perfect contact between the upper carbon and the central tube. All users of arc lamps have experienced more or less trouble from sliding contacts attached to the upper carbon holder, the purpose of these contacts being to carry the current from the source of supply to the movable upper carbon.



G. I. ALTERNATING-CURRENT ARC LAMP.

In the new G. I. alternating-current lamp the current for the upper carbon is supplied through a flexible wire which is applied to the lamp in a manner heretofore unpracticed. In designing the dash-pot a new mechanical idea has been evolved which is sure to prevent the sticking of this generally troublesome part of the mechanism.

The lamp is equipped with two solenoids and a U-shaped core. The skeleton for the solenoids is made of vulcabeston, molded into the proper shape. This, while a rather expensive construction, is justified when it is found that the heating effect in the coil is cut down about 25 per cent. The wire used in the coils has a carrying capacity of 25 per cent. over the maximum ever required by the lamp. The suspension of the solenoids is an entirely new feature, for which patent has been applied, and is sure to prevent any possible vibration being transmitted to the lamp frame. A special device has been provided, the result of which is the confinement of all vibration of the U-shaped core within itself, thus preventing the mechanism from rattling, in other makes a great objection to alternating-current lamps.

Another important feature of the new G. I. lamp is the choke-coil, which, being made in two sections, guarantees ease of repair in case of trouble in the hands of the ordinary user. These coils are machine-wound and provided with suitable loops, which allow a great range in adjustment, making the lamp suitable for any commercial circuit. Much care has been taken to produce a quick, simple and practical trimming device, by the use of which it is impossible for the inner globe to crack by its own expansion. To the outer globe is screwed a metal ring provided with two substantial spring catches. These catches hook into the rim of the outer cover, thus supporting the globe and making a dust-proof and practically water-proof joint. When the lamp is to be trimmed it is only necessary to pull out these catches and lower the outer globe, which will then be supported by two chains. This leaves free access to the inner globe and to the trimming device. The carbons used are 9½ inches by one-half inch, cored or solid, in the upper holder; in the lower holder, 5¾ inches by one-half inch, either cored or solid. The cover of the lamp is supplied with large ventilating apertures. The length over all is 25 inches with outer globe and 24 inches with reflector shade. Life will vary from 75 to 80 hours, depending on the quality of the carbons. As with all its other manufactures, this company is prepared to furnish these lamps in any known finish.

Heavy Traffic on Chicago Elevated and Street Railways.

Festival week added greatly to the business of the elevated and street-railway lines of Chicago. October 9th, Chicago Day, proved the banner day of the week, the companies handling on that day more passengers than they had before in years, and some of the roads broke all records since the World's Fair. The elevated lines had a larger percentage of increase than the surface roads. The Metropolitan carried the greatest number of passengers for the day, with the South Side Elevated a close second. The Lake Street road also made a good showing. The number of passengers carried over each of the three elevated lines during the day was as follows:

Metropolitan	186,390
South Side	169,987
Lake Street	85,438
Total	441,815

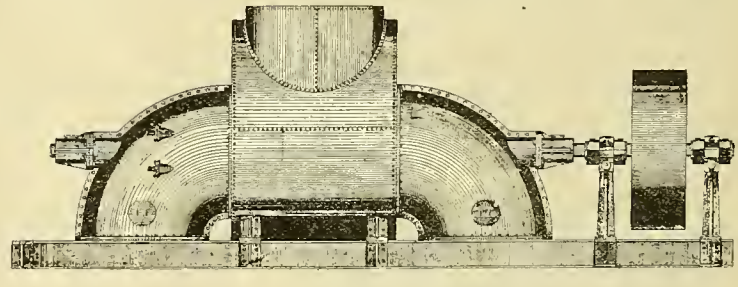
The estimated business of the various surface systems for the day is placed at 375,000 passengers for the Chicago City railway, 350,000 for the West Chicago lines and 225,000 for the North Chicago lines. The grand total for both elevated and surface lines is thus 1,390,000 passengers.

Taylor Sleeve-gate Turbine.

The illustration represents a Taylor sleeve-gate turbine water-wheel on horizontal shaft. The inventor of this turbine is John Williams Taylor, a mechanical engineer of Atlanta, Ga., and the machine is manufactured by the Glamorgan Pipe and Foundry company of Lynchburg, Va.

The gate of the wheel proper is a close-fitting sleeve around the outside of the chute box. The runner is made cone-shaped and gradually expands from the top diameter to the band. The principal claims of the patentee are tight-closing gates, higher efficiency at part gate, sensitive, easy working gates that will respond readily to action of governor and increased power for a given diameter.

The wheel is manufactured in 23 sizes, both right and left-hand, and is made in every style for vertical or horizontal settings. Those interested in the development of water power are asked to correspond with Mr. Taylor, who may be addressed at the Austell building, Atlanta, Ga.



TAYLOR SLEEVE GATE TURBINE.

Arnold Electric Power-station System.

Four years ago, while acting in the capacity of consulting electrical engineer for a long-distance, high-speed electric line, Mr. Bion J. Arnold of Chicago worked out as a solution of the problem of electrical generation and distribution for such service the following system: The road was to be divided into sections, and at about the middle of each section, except that one contiguous to the power house, was to be located a sub-station, containing a storage battery and an equipment of rotary transformers and converters. These transformers and converters were to receive their energy over a three-phase transmission line extending back to the high-tension, alternating-current generators in the main power house. This power house was also to contain direct-current machinery sufficient to supply the section of road adjacent to it. This arrangement presented so many advantages over the ordinary direct-current distribution system that when Mr. Arnold was called in as consulting engineer for the Chicago and Milwaukee electric railway it was the system which he advised, and the first section of the road, extending from Waukegan to Highland Park, was built by C. E. Loss & Co. after this plan, with a sub-station at North Chicago, containing only one rotary converter without a storage battery, and a power house at Highwood, containing one 5,500-volt, three-phase alternator.

The extension and completion of the line brought about a change of management and developed some opposition to the alternating-current system. But Mr. Arnold was so thoroughly convinced that this system possessed advantages both as to first cost and economy of operation, that the Arnold Electric Power Station company of Chicago, of which he is president, submitted to the officers of the company a proposition to complete the equipment of the road along the original lines, and guaranteed the system to work with a certain specified efficiency. Under these conditions, the contract for the extension, with the exception of the rolling stock and track, was awarded to the Arnold company. This contract included the engine, direct-current and alternating-current generators, switchboards, transformers, rotary converters, economizer, pumps, mechanical draft, condensers, piping, cooling table and reservoir, power-house building, battery room, car barn, offices, two sub-stations, overhead equipment and transmission line erected complete ready for operation. The contract for this equipment would have been notable in itself, but the economy clause gives to it an added interest.

The policy adopted by the Arnold Electric Power Station company of working out its own solution of an engineering problem, of submitting plans and specifications with its proposition, together with an economy guarantee covering the entire installation, takes this company at once out of the ordinary class of contracting companies and places it in a position peculiar to itself. Another unique feature of the Arnold company's methods is that it is in no way connected with any manufacturing company, which leaves it free to purchase machinery and apparatus of any make upon the open market.

Throughout the work upon the Chicago and Milwaukee road the most pleasant relations have existed between the officers of the road and the Arnold company, which is a condition somewhat out of the ordinary experience. It will be of interest to study briefly the history of a company which has business, technical and construction departments organized sufficiently to carry a contract of such magnitude through to a successful conclusion.

The Arnold Electric Power Station company was organized in 1896 to make and sell the parts peculiar to the "Arnold system" of power-station construction, and acting in this capacity it has supplied a number of plants with magnetic clutches, shafts, quills, box stands and couplings.

Among these plants may be mentioned the Fort Dodge Light and Power company, Fort Dodge, Ia.; Chicago Board of Trade; Englewood and Chicago electric railway; Land, Title and Trust building, Philadelphia; University of Michigan, Ann Arbor, and the W. B. Conkey company, Hammond, Ind.

Through natural development this company has gradually broadened the scope of its work, until it is now in position to make a proposition for furnishing and erecting in place entire electrical properties, and it already has an enviable record along this line.

The entire power plant and building of the Imperial Electric Light, Heat and Power company, at St. Louis, Mo., was constructed by the Arnold company. This plant is a large central station, using 500-volt generators, working in parallel with a stor-

age-battery auxiliary. By dividing this battery into two parts a distribution system was devised, which allowed the use of 220-volt incandescent lamps, arc lamps and power motors off the same mains—a decided departure in central-station practice. This system has been adopted for another large central station since the erection of the Imperial plant.

The Arnold company was also given the contract for the complete light, heat and power plant erected in connection with the new railroad shops of the Chicago Great Western railroad at Oelwein, Ia. This contract comprised not only the heating and lighting of the shop buildings, covering many acres, from a central plant, but also the application of a large number of motors for various uses. This is the first plant to adopt the Arnold magnetic clutch for line-shaft work, though these clutches have been used for some time in connection with the three-way couplings, which are a part of the Arnold system of power-station construction.

Another notable installation, recently completed, is the isolated plant for the Garrett building, Chicago, which is occupied by a large wholesale grocery establishment. This contract included a complete system of lighting and power wiring for 45 motors, a storage-battery auxiliary, with booster and switchboard, and three generators connected by means of the Arnold system to two high-speed engines. The plant is remarkable for the small amount of space occupied.

It is predicted that many railroads will be built upon the plan of the Chicago and Milwaukee electric railroad, and that the Arnold magnetic clutch and the Arnold system of power-station construction will become well-known features in power-station work.

The advent into general electrical contracting work of the Arnold Power Station company, prepared, as it is, with an organization capable of handling the largest contracts and willing to guarantee the operation and the economy of a completed plant or installation, is a development which promises to bring about new methods in building extensive electric properties.

Proposed Sale of Chicago Edison Company.

[From the Chicago Tribune.]

The plan for the reorganization of the Chicago Edison company, under which the control will pass to a syndicate composed largely of New York capitalists, has been completed. W. G. Beale, who is acting as counsel for the company and who has been in New York for the last two weeks conferring with the counsel for the eastern capitalists, has returned to Chicago, bringing with him the form of agreement which has been decided upon. The new company will have a capital stock of $25,000,000 and a bond issue of $25,000,000, payable in gold, running for a period of 50 years, with the privilege of retirement at an earlier date, and bearing four per cent. interest. William C. Whitney, Anthony M. Brady and M. J. Maloney of New York, and P. A. B. Widener and W. L. Elkins of Philadelphia will be the men who will practically control the new organization. Samuel Insull, who is president of the company, will continue in that capacity. The present stock of the Chicago Edison company is $5,000,000 authorized, with $4,975,900 outstanding. The offer that is to be made to stockholders of the company is to give for each share of stock of par value of $100 bonds of a face value of $200 and one-half share of stock. This has already been accepted by the large stockholders and a majority has agreed to accept the exchange offered. This will call for approximately $10,000,000 of bonds and $2,500,000 of stock, leaving $15,000,000 of bonds and $22,500,000 of stock. The stock will go to the promoters as profits. Of the excess of bonds authorized there will be set aside an amount sufficient to pay $4,808,000 of bonds of the Chicago Edison company and $2,500,000 of bonds of the Commonwealth Electric company, which is owned by the Chicago Edison company and which will be turned over to the new corporation. It is expected the entire matter will be closed up in the next 30 days. While the same people will be in control of the Chicago Edison company as are in control of the Chicago Union Traction company, there is no intention of effecting an active combination between the two corporations. There will be close relations between the two companies, however, and it is said to be the intention to make a contract under which the Edison company will furnish much of the power needed for the operation of the lines of the traction company.

Electrical Supplies for Fortifications.

The secretary of war has appointed a board of officers, consisting of Lieutenant-colonel Alexander Mackenzie, Corps of Engineers; Major M. C. Martin, Quartermaster's Department; Major James Allen, Signal Corps; Captain William Crozier, Ordnance Department, and Captain J. R. Williams, Seventh United States Artillery, to meet at the War Department at the call of the president of the board, to make recommendations concerning the proper source of supply, by the staff departments, of all electrical appliances and apparatus in use at fortifications and the materials and accessories relating thereto, with the view of furnishing uniform types and providing for the control, responsibility and efficiency of the apparatus. Other subjects to be considered are the proper means by which repairs to guns and gun carriages at fortifications shall be made, and by which department the necessary tools and appliances for such purpose shall be furnished; the qualifications of electrician sergeants and the character and scope of examinations for their appointment, and the proper source of supply by the staff departments of the tools and implements required for the use of the battery mechanics for each heavy battery of artillery.

Standard-gauge Storage-battery Road in Italy.

On February 7, 1899, the first standard-gauge electric railway was opened for traffic in Italy. It is the line between Milan and Monza, in Lombardy. This railway line, which, by the way, happens to be the oldest of all lines in Italy, has relatively only a short length, about eight miles, but, nevertheless, the change to electrical power ushers in a new era for the whole Italian railway system. For Italy, in particular, where coal is scarcer and more expensive than in any other country, where the railways, more than anywhere else, have to contend with great surveying difficulties, and where, on the other hand, there exists an abundance of water power awaiting useful application, the application of electricity on the great railway systems, or at least a part of them, is of far greater importance than for any other country.

A traveler who recently made a trip along the short western coast line, through districts which were greatly damaged by the short but rapid mountain streams, said of the richness of the unemployed water powers: "Many years ago a Bologna University professor stated that Italy possesses five million horse power in her mountain rivers. From Pesaro to the province of Teramo, no less than 15 rivers fall into the sea, which, on an average course of 60 kilometers, have their rise in a height of from 1,000 to 1,200 meters, thus representing an immense power, but all this energy, far from bringing any advantage to the population, causes only destruction."

On the new Milan-Monza line a system of accumulators has been adopted. It is comparatively expensive to operate, but did not demand any reconstruction of the tracks already laid. The cars are built after the American system, with two trucks, and are 17.8 meters long, 2.5 meters high and 2.85 meters wide. They contain in two first-class compartments 16 seats for smokers and eight seats for non-smokers, and in two second-class compartments 24 seats for smokers and 16 seats for non-smokers. Each of the two covered platforms on the head ends is divided so that the outside half forms the cabin for the motorman and the inside half standing room for passengers. All compartments are connected through a middle gangway and can be separately closed. The interior and the platforms are lighted by 18 10 candle power lamps, while five 25-candle lamps serve as signal lights on both car ends. Besides a hand-brake there is a Westinghouse air brake and a special air-reservoir for the signal whistles.

The motors and all electrical apparatus of the cars now running on the line were imported from Germany, while the cars themselves and the storage batteries are of Italian origin. Each car has four motors and a battery of 130 elements, giving the cars an average speed of 45 kilometers, so that the whole distance, including stops at different stations, is covered in about 20 minutes. If necessary, however, this speed can be increased. For lighting purposes there is a second accumulator battery, and both batteries together weigh 17 tons, while the total weight of each car amounts to 58 tons. Such a car is not much lighter than an average locomotive, but it contains not only the power machinery and room for the transportation of 70 to 75 passengers, but at the same time sufficient power to draw one or two more cars capable of carrying the same number of passengers.

The price of each of these cars is 100,000 lire (about $20,000). There are now two cars running on the line, making daily in each direction 11 trips between Milan and Monza. Several more cars of the same type are being built. The batteries are placed in separate cases below the bottom of the car.

As power station for the electric line the great central power station worked by the turbines of the Adda, and built by the Italian Edison company, near Paderno, serves at present. The batteries are charged in an hour, it is said, and then give sufficient power for a running distance of 80 kilometers or for three round trips. Thus, each car has to be charged twice a day.

The Mediterranean Railway company has given orders for similar cars for traffic on the line between Milan and Pavia, capable of running 36 kilometers.

It is reported, however, that another great Italian railway company, the Rete Adriatica, seems to be more favorably disposed toward the usual method of transmitting the current to the cars by conductors connected to a power house. This company is reconstructing at present its lines Lecco-Sondrio and Colico-Chiavenna, 79 and 26 kilometers long, respectively, which are to be worked by overhead electrical conductors, receiving their power from an Adda electric plant, near Morbegno, in the Veltin. Another line of the same company, 42 kilometers in length between Bologna and San Felice, is to be worked by large storage-battery cars with accommodations for 60 passengers.

It is worthy of note that in 1898 the imports of electric machinery into Italy amounted in value to 8,705,000 lire, as against 4,761,000 lire in 1897. Thus the imports of 1898 represented a value of about $1,700,000, of which only $157,846 worth was of American origin. According to all probabilities the demand for electrical machinery will continue to increase year by year, and a watchful eye should be kept upon the Italian market.

Long Three-phase Electric Railroad in Northern Ohio.

An interesting electric railroad is to be constructed between Toledo and Norwalk, O. Starting from Toledo, it will run in a southeasterly direction, passing through Genoa, Woodville, Hesseville, Fremont, Clyde, Bellevue, Monroeville and thence to Norwalk. The distance traversed will be over 60 miles, 31 miles of which is on the Maumee and Western Reserve turnpike in Sandusky County.

Some time ago the promoters appointed Westinghouse, Church, Kerr & Co. the engineers and architects for the new line, and that firm is designing the system throughout, including the electrical equipment, the central-power station, the sub-stations for feeding the lines, the overhead construction, car shops, car barns and the general equipment of the road. The contract for the execution of these plans, also, has recently been awarded to Westinghouse, Church, Kerr & Co. The road will be built in a thoroughly first-class manner and will embody the most advanced ideas in electric-railway construction.

The central power house will be at Fremont, near the center of the line, and, instead of direct current, three-phase alternating current will be employed, which will enable the whole line to be supplied from one central power station. The power station will be furnished with five 300 horse power Babcock & Wilcox boilers, equipped with Roney mechanical stokers and coal and ash-handling machinery. Two 4,000 horse power Worthington central elevated jet condensers will be provided, and a Westinghouse mechanical-draft and economizer system will be installed. The feed water will be treated before being pumped into the boilers to remove the scale-forming properties. The exhaust steam from the auxiliary engines will be used for heating the feed water on its way to the economizer. Four Westinghouse Columbian-type engines will be directly connected to four 500-kilowatt Westinghouse "engine-type," three-phase generators. Two 9 by 15 by 9-inch Westinghouse single-acting compound engines will be directly connected to two 30-kilowatt exciters.

In addition to the Fremont central power station, six sub-stations will be built about equidistant from one another along the line of the railroad, while a seventh sub-station will be provided within the power house at Fremont. The current generated at the central power station will be raised by Westinghouse transformers and transmitted at a high voltage—about 15,000 volts—to the sub-stations, and there lowered by Westinghouse step-down transformers and changed by Westinghouse rotary converters from alternating to direct current for feeding the trolley lines. Each sub-station will be equipped with three step-down transformers and two rotary converters, together with a switchboard and controlling apparatus, and will be connected by feeders with the trolley line and direct-current feeders.

The roadbed will be very substantially constructed, as it is intended to run the cars at a speed upward of 40 miles an hour.

By adopting the alternating current it is possible to supply the entire 60 miles of the Toledo, Fremont and Norwalk electric railroad from one central power station, and to reach out to supply railway feeders in all directions or extend from the termini. The saving in copper wire alone by using a high-tension transmission is estimated at considerably more than $100,000.

The power plant at Fremont is designed to admit of ready extension without destroying the symmetry of its design. The building will have a fireproof roof and a traveling crane will span the engine room. The sub-stations will be arranged so that they will be operated with very little extra attention, being combined with passenger and freight stations at most points.

Expert Treatment in Detroit.

[From the Detroit correspondent of the Western Electrician.]

George Darling of the O. B. Cook company fell off a Citizens' electric car when it was going a 12-mile gait and landed on his head. He had the diabetes for two years previous to the accident, but is now pronounced cured. Dr. Obetz says that he was cured by the shock. Darling had thought of suing the street-railway company for damages, but it is now reported that the officers of that corporation are considering the commencement of a proceeding against him to recover an adequate amount of fees for expert treatment.

Licensing Employes on Electrical Work and Improving the Quality of Work and Material.[1]

By William Brophy.

Electricity has such a wide application that the men who are perfectly familiar with all its branches are somewhat rare, and for that reason electrical workers must be, to a great extent, specialists; in other words, they must become experts in some one or two branches of electrical business. For this reason I shall be obliged to discuss the qualifications necessary for men occupying positions in some of the most important branches of the electrical business.

No doubt, the greatest need for skill and expert knowledge exists in the electric-light and power branch of the electrical business, not that it is more important than the telephone and telegraph service, the fire and police-signal service or the street-railway service, but because the dangers resulting from improperly installed electric-light wires and appliances are not fully appreciated by city and town authorities and the great thinking and unthinking public. While I contend now, as I have always done in the past, that electric lights, properly installed, are the safest form of artificial illumination, yet when installed by incompetent or dishonest persons, they become a menace to both life and property.

In the city of Boston alone 66,774 horse power is converted into electrical energy; 34,500 of this is used for the propulsion of street cars, leaving 32,274 horse power to be converted into light and power, through the medium of electric motors. All this vast amount of power passes over and under the surface of the streets and through the stores, warehouses, theaters and other places of amusement, churches and dwellings. This energy is converted into three systems of electric lighting—arc, direct-incandescent and the transformer system. The difference of potential at the brushes of the arc dynamos is from 4,330 to 8,415 volts; with 10 miles of wire in each circuit these figures would be 4,371 and 8,436 volts difference of potential at the brushes of the dynamos. In one case there would be 58 lamps in series, while in the other there would be 115.

It is hardly necessary for me to state that the greatest care should be exercised in installing the wires, lamps, switches and other appliances which go to make up one of these circuits. With the present type of insulating covering for overhead wires, it cannot be said that any of the overhead portion of the circuit is insulated during stormy weather, and very little of it at any other time. Were it possible to maintain the absolute insulation of these circuits at from 50 to 500 megohms per mile, there would be but little danger attending the transmission of electrical energy, but, unfortunately, the insulation of overhead circuits cannot be maintained at even one megohm, and there are times when many of them do not maintain an insulation resistance of 500 ohms per mile. For this reason it is absolutely necessary that the insulation of all portions of these circuits that are contained in buildings of any kind should be maintained at the highest possible point; the insulating covering of wires should be handled with the greatest care and not injured through carelessness or ignorance; the translating devices should be of the best and of a type adapted to this particular kind of service, and wires, lamps, switches, etc., should be placed beyond the reach of all persons, whether owners, occupants, employes or others, except those who have the care and supervision of the same. All this is necessary in order to keep this silent, subtle and mysterious force within the limits of the path over which it should traverse, for when once it leaves its prescribed course, the damage it may cause to property cannot always be estimated, and, worse still, loss of life may result when it traverses the human body.

Next comes the alternating system of incandescent lighting. The greatest care is taken to insulate the primary and secondary coils, one from the other, in order to prevent the high-tension current from entering the secondary or house circuit; but the insulation on dynamos and transformers can be destroyed if either are overloaded or taxed beyond their capacity, which may be done in several ways, namely, by attempting to supply too many lamps, by an accidental short-circuit between the secondary mains; and last, but not least, by defective insulation of the wires and fixtures within the buildings; this has, in the past, and will, in the future, cause the failure of transformers, resulting in fires and possibly loss of life. The amount of current flowing through any circuit is in proportion to the resistance, and the resistance of any circuit where the lamps are in multiple arc is decreased as the number of lamps is increased, and nearly all incandescent lamps are in parallel or multiple arc; by placing too many lamps in a circuit the resistance is reduced and the flow of current increased possibly to such an extent as to overheat the wires and destroy the insulation of the transfomer; an accidental short-circuiting of the secondary mains will bring about the same result, but in that case the safety fuses are apt to melt before the insulation is injured, unless, through ignorance or carelessness, copper wire is substituted for fusible metal, or the carrying capacity of the latter is greatly in excess of the circuit it is designed to protect. The greatest source of danger, however, is from poorly insulated wire and fixtures, from which current escapes slowly at first, increasing gradually, until its volume is sufficient to cause a fire at the point of escape, or in the transformer, when fires are sure to break out at nearly every lamp and fixture; if this does not occur, there is danger to every person handling lamps, switches, etc., particularly when standing on moist ground or when in contact with steam radiators, gas, water or drain pipes, and any other conducting substances connected to the ground.

The direct low-tension system of incandescent lighting has nothing intervening between the dynamos, lamps, motors and other appliances in the shape of transforming devices, the current from the generator going to the lamps, motors, etc., at practically the same pressure at which it leaves the same. Injurious shocks cannot be received by persons from the wires of this system, as the difference of potential between lamp terminals is constant and does not vary with the number of lamps, motors, etc., in the circuit, but the amount of current is not constant, but varies with the load. While imperfectly insulated wires, fixtures and appliances in this system will not cause injury to persons who handle or come in contact with them, yet the danger of fire resulting therefrom is as great as from any other system of electric lighting.

The construction of constant-potential circuits requires the greatest possible care; in order to secure uniform candle power the drop in the wires must be determined accurately and must be uniform throughout the entire system; the safety fuses (which are the safety valves) must be properly proportioned to the safe carrying capacity of the conductors; the wires must be highly insulated from each other and the ground; switches must be of ample carrying capacity, mechanically strong and durable; the insulating covering on wires must be of the best quality, particularly when conductors are placed in conduit or in the stems of chandeliers or side brackets; when supported on porcelain insulators and cleats and in tubes of the same material and opposite poles well separated, no trouble will result from such wires, even when the covering thereon ceases to be an insulator.

Power circuits designed to supply energy to electric motors exclusively require the same care in construction and the same quality of material and appliances as those already described.

The difference in potential 500 to 550 volts does not endanger the life of human beings who are in the enjoyment of good health, but the danger of fire, due to improper construction and other causes, is as great as in the systems already described.

Street-railway systems, owing to the fact they enter no buildings but the power houses and car stables, will not receive much attention at my hands at this time.

Last, but by no means least, comes the fire and police-signal service. There is no branch of the municipal service that equals these in importance as bearing on the safety and welfare of the community, except the fire and police departments, of which they are the nervous systems.

Can anyone for a moment contend that these two important systems should not be constructed in the best possible manner and maintained in the highest state of efficiency? Should any but the most competent persons be placed in charge thereof? And should they not be given the very best and most competent men as assistants? These are questions that can be answered only in the affirmative by any public official or private citizen, if they will only familiarize themselves with the workings of both of these systems.

Without at this time attempting to combat the belief that exists in the mind of the active politician that "to the victor belongs the spoils," I do contend that the position of superintendent of fire and police telegraphs should not be counted among the assets of the spoilsmen. While it is perfectly proper that these officials should be selected from among those of the same political creed as the appointing power, they should be qualified in every way to perform the duties, and should be obliged to prove their ability before some authorized person or board competent to decide impartially, and who possess the respect and confidence of all classes in the highest degree, and whose certificate or license should be of value to the holder.

The time has come when municipalities must undertake the supervision of all classes of electrical construction; many are already doing so. The superintendents of fire and police-signal systems, particularly in medium and smaller cities, should be qualified to undertake such supervision, as in most cases they will be called on to do so. For them to accept such a position through false pride or an increase of salary, knowing themselves to be incompetent to supervise the work of what ought to be the most intelligent class of electrical workmen, and others not over-scrupulous, would, in my opinion, be a crime, and to appoint them under such conditions would be one only in a less degree.

I will now endeavor to point out the necessary qualifications of men engaged in some classes of electrical business, and in doing so I will follow in the lines established by the "New England Electric Exchange," an organization formed and supported by men engaged in electrical pursuits some years ago, for the purpose of maintaining a high standard of workmanship and intelligence among the fraternity. As a result of the good work done by that organization all classes of men sought and, when possible, procured one of the five classes of licenses issued by it.

These certificates proved a sure passport to a position for the holders thereof, and nearly all the officers of electric-light, railway and power companies and contractors required their employes to appear before the examining boards and obtain one of the licenses (five in number) if they wished to remain in their employ; and, as a rule, the holders of such licenses were sought for by those needing the service they could render in preference to others.

This system of licensing proved a blessing in many ways; it insured the highest grade of intelligence in the different grades of work; it proved an incentive to young men to attempt to reach the highest round in the ladder. I know it to be a fact that many who were only able to secure a rating that entitled them to the lowest (fifth) class license, worked and studied until, step by step, they reached the highest, or close to it. The contractor and manager obtained the best workmen; firms and corporations secured the best class of men for superintendents and managers; and, best of all, the public received all the protection possible from dangers that might arise from the distribution of electrical energy.

The qualifications of the applicants were as follows: The applicant for a first-class license had to be able to make working plans of central stations and isolated installations; to have a general knowledge of the construction of dynamo-electric machines and the electrical appliances necessary for electric-light and electric-power installations; a general knowledge of the principle, construction and installation of secondary or storage batteries; a thorough knowledge of the insurance rules pertaining to the business; a specific knowledge of the systems operated by the applicant, and a thorough knowledge of the calculations necessary for and the rules governing electric wiring, and be able to make complete wiring plans. While not requisite, a general knowledge of steam and water-power plants was desirable, and would have due weight with the examiners.

The man who possessed these qualifications could fill the position of superintendent of electric-lighting or street-railway plants.

Second-class licenses were issued only to persons fully competent to install and operate incandescent-light, arc-light or power plants, who were obliged to have a general knowledge of the construction and operations of dynamos, electric machines and other electrical appliances pertaining to the particular classes of apparatus it was desired to operate, a thorough knowledge of the insurance rules pertaining to such apparatus, and a thorough knowledge of the calculations necessary for and the rules governing electric wiring. While not requisite, a general knowledge of steam and water-power plants was desirable, and would have due weight with the examiners.

Third-class licenses were issued only to persons fully competent to make electric-light and power installations, and who were not competent to operate electric machinery. They were obliged to have a thorough knowledge of the calculations necessary for and the rules governing electric wiring and the ability to make complete wiring plans; also a thorough knowledge of the connecting of electric-light and power machinery to the wiring, and a thorough knowledge of the insurance rules governing wiring for electric light or power. The holders of these licenses were classed as wiremen.

Fourth-class licenses were issued only to persons competent to install and operate but one of the following plants, viz., incandescent-light, arc-light or power. Such persons were obliged to have a specific and thorough knowledge of the installation and operation of the class of apparatus it was desired to install and operate, together with the knowledge and ability necessary to do the wiring pertaining thereto, and a thorough knowledge of the insurance rules governing the class of apparatus to be installed and operated.

Fifth-class licenses were issued to persons competent only to operate electric machinery and who were not competent to do electric wiring.

The applicant had to possess a general knowledge of the operation of the particular electric-light or electric-power machinery it was desired to operate, and a thorough knowledge of the insurance rules pertaining to such machinery. In all such cases storage or secondary batteries were included under the head of electrical machinery.

All licenses were valid for one year from their date, but the licensee could apply within that time for examination for a license of a higher class, or could renew the original upon its expiration.

The examiners were men of known ability and practical experience, and the examinations, while necessarily technical in some classes, were as practical as possible in all cases.

Many young men, many of whom had received a technical education, who were confident of carrying off the highest prize—a first-class license—found themselves placed much below that much-coveted goal; while very many others, who modestly sought one of the lower grades, were placed one or two grades higher. These latter, as a rule, had limited educational advantages, and did not occupy

1. Abstract of paper read at the annual meeting of the National Association of Municipal Electricians, Wilmington, Del., September 5, 1899.

a commanding social position, but had acquired habits of industry and perseverence, and many of them are occupying responsible positions to-day.

I contend that the good work done by this organization should be continued by either state or municipal authorities, because it would benefit all and injure none. Competent men need have no fears of such a system, and surely incompetents should not be entrusted with a class of work on which so much depends.

It is true that this system extended only to those engaged in the electric-light and power branches of the electrical business, but it should also apply to those engaged in the care and construction of fire and police systems.

It has been the practice in the past (I hope it is not so at present) for the agents of rival signal systems to attempt to impress on the minds of the city and town authorities that their particular system needed little or no attention once it was installed; that a little sulphate of copper dropped into the bottom of the cells of the battery and a little water poured in to cover the zinc would allow it to take care of itself, and when open-circuit batteries were used no attention need be given them. This kind of deliberate misrepresentation resulted in the appointment of someone to the nominal position of superintendent of one or both of these signal systems, at what must be a nominal salary in many cases, while the honor of bearing the title was considered ample remuneration in others. Those who secured such positions and those who appointed them soon realized that intelligent supervision was necessary and cheapest in the end, after paying a high rate per diem, together with traveling expenses, to the manufacturer's employes to find an open circuit, locate a ground, adjust a gong, bell-striker, whistle-blower or box, or bring a practically dead battery to life; while the taxpayers might thank their stars if property in excess of the entire cost of the signal system and the amount of the salary of a competent superintendent during his natural life was not destroyed, because the fire department could not be summoned by a system supposed to take care of itself except that given it in the manner above described.

Some of my own personal experience with persons entrusted with the care of electric-light and power plants was and is enough to make one shudder at the possible consequences due to either the misplaced confidence or parsimony of their employers; while many of those engaged in electrical construction possessed as little knowledge of the laws of the current or the established rules governing the work they were engaged in as a Digger Indian does of the solar system.

The youth who succeeds in connecting up a few cells of a battery, a push-button and call-bell, and who, in the opinion of his fond parents and neighbors "knows all about electricity," cannot be called a good wireman. The man who installs speaking-tubes, annunciators, call-bells and gas-lighting systems cannot make wiring plans, estimate the size of conductors and place the same in position for electric-light, heat or power purposes until he has a proper training in that kind of construction.

The man who believes the dynamo-electric machine generates electricity in the same manner as does the frictional machine of his school-boy days, and that the large number of dynamos now in operation will soon "so charge the earth that it will burn up or explode," who makes additions to existing wiring with annunciator wire, because it is easy to handle, or iron wire because it is cheaper than copper, and who uses copper or iron wire, printer's lead, iron nails or anything handy because they are more durable than fusible metal, is evidently out of place when in charge of an isolated plant.

Last of all are the men who have "pulls," are active political workers, who give freely of their time for the benefit of their party. I concede that they have a perfect right to do so, but this fact should not entitle them to a position as superintendent of fire and police telegraphs or municipal-lighting plants, unless they possess the necessary qualifications for the positions.

Finally, I believe it to be the duty of all who are engaged in any branch of the electrical business, particularly the members of this association, to do everything possible to establish in every state in the Union a system of license for electrical workers similar to that which I have described, which was a perfect success from the start, receiving the active support and approval of the best men in the electrical business.

Can anyone here for a moment defend the systematic attempts of contractors, manufacturers and others to introduce the cheap, flimsy devices with which the markets are flooded, or the compounds that are used as a substitute for the insulating covering of wires? I think not; but a wider or more fruitful field for the makers and venders of the worst shams that ever were imposed on a confiding public does not exist than the electrical. No matter how earnestly or faithfully men like myself may labor for the suppression of material and devices that are no better than shams, that bring into disrepute the use of electricity and endanger the lives of the community and make possible sweeping conflagrations, the makers will still find a market for their wares in territory beyond the jurisdiction of the faithful, honest, fearless and conscientious municipal inspector.

Boston may condemn these shams and drive them beyond its borders, and at the same time administer a scathing rebuke to those who would in a sense become the executioners of their fellow-men and destroyers of their worldly goods; but the men only laugh and say there are other markets in which there are no restrictions on this damnable traffic; and the average customer, left to himself, knowing nothing of the safeguards necessary to be thrown around this subtle power, drives the closest bargain he can and buys that which costs least at first, but may prove fearfully expensive in the future. This state of affairs will exist so long as the great majority of the people will persist in remaining in total ignorance of this, to them, mysterious power, or until municipal authorities protect their citizens from this class of worse than impostors through the medium of able, honest and fearless supervisors, who stand above reproach, whose word is as good as a bond, whose decisions cannot be questioned, and, best of all, who bring down on their devoted heads the wrath of the class here described.

The doors of the jail should be opened wide and closed for long terms on those who would make, sell or use any device or material to be placed in an electric circuit, knowing it to be unsuitable or unsafe.

I charge those of you that are entrusted with the supervision of electrical construction to make relentless war on material and devices whose only recommendation is cheapness, and keep close watch on those who would make, sell or use them. To those in charge of fire and police telegraphs I would say, bear this motto in mind at all times, "The best is none too good for the systems in your charge."

The Prevention of Smoke by the Use of Pulverized Carbon.

The smoke nuisance in Chicago and other cities induces interest in any method calculated to abate the annoyance. The following, from the Revue Universalle des Mines, descriptive of the Schwartzkopff method of using pulverized coal, is of interest, as a late attempt to solve the problem.

M. Schwartzkopff has abandoned the bellows for driving pulverized carbon into the furnace. His apparatus consists of a hopper placed in front of the fire chamber, filled with finely comminuted coal dust. This hopper is closed at the lower part by a flexible metallic plate, before which is a drum, furnished with revolving steel brushes turning at the rate of 900 revolutions per minute.

At each revolution a cleat on the drum raises the flexible plate and a small quantity of the dust is drawn out and projected into the furnace.

The air necessary for combustion is admitted into the furnace through openings capable of regulation, independent of the entry of the carbon, which permits of regulating the temperature of the air into which the dust is forced. Another characteristic of the action is the fact that once the quantities of air and combustibles are completely regulated, the conditions remain constant. The proper proportion of each is shown, it is asserted, by a complete disappearance of the smoke. A complete mixture of oxygen and carbon is thus accomplished, the quantity of air being only just so much as is required, while in ordinary furnaces the admixture of air is in excess, corresponding to a loss.

Experiments made with different coals by M. Schneider, chief engineer of the association for the inspection of steam boilers in Berlin, showed that the percentage of efficient heat communicated to the water in the boilers varied between 72.1 and 79.6° Centigrade. The first installation of the Schwartzkopff system was made in 1895, at the cement works at Malstatt, near Sarrebruck, where a result of a production of 7.2 to 8.7 kilogrammes of steam per kilogramme of coal dust was attained. Since then other installation tests have been made, and wherever the system has been used it is said that an economy of fuel of between 20 and 30 per cent. has resulted.

In addition to the advantage of a combustion which produces no smoke and is complete, the utilization of all the coal pile is possible, whether this comes in powder or in lumps, which is not the case except in this method of firing.

And again, the regularity with which the combustible is fed to the fire is favorable to the preservation of the steam-raising apparatus, and the service of the fireman is rendered far less irksome. This service consists only in overlooking the apparatus during watch and in the removal of the ashes from the front of the ashpit. One man can attend to 10 or 12 boilers.

The lighting of the fire is readily accomplished by means of a little wood kindling or a bunch of oakum dipped in coal oil. A few minutes only is required for this purpose. It is easy to force the work of the boilers by increasing the weight of the fuel per unit of time.

It is absolutely necessary that an extremely fine powder be used, sifted through sieves not coarser than those having 900 meshes to the square centimeter. This degree of fineness may be obtained by the use of ball pulverizers or the centrifugal cylinder braying machines of Propfe.

The coal to be pulverized may contain from three to five per cent. of humidity, and even more, and M. Von Neumann has stated that lignite having 20 per cent. of humidity was pulverized without difficulty. In May, 1895, an Austrian firm, Fried Von Neumann, at Marktl, constructed a furnace for reheating metals, furnished with the Schwartzkopff apparatus. After a few months a puddling furnace was arranged for the same system and subsequently other furnaces were so constructed. The employment of these furnaces gave, according to the firm's engineers, an economy of 40 per cent. of coal on the Boëtius furnaces, with less refuse, and at the same time an increase of 20 to 30 per cent. in products.

In conclusion, it is stated that the Schwartzkopff process has the advantage of better utilization of the heat furnished, the complete consumption of the dust of the coal, and finally, the suppression of the smoke.

Electric Railway for Hawaii.

Construction work on a new railway to be built on the island of Hawaii will soon be commenced. The road will be known as the Kohala and Hilo railway and will connect the port of Hilo, the principal city on the island, with Mahukona and Kohala. It will have a total trackage, including branch lines, of 130 miles and will open to cultivation a large fertile territory heretofore inaccessible on account of the lack of transportation facilities. The road is to be operated by electricity, which will be generated by water power. Three power plants will be built, each plant to be of sufficient size to furnish power to run the entire road in case of necessity. These plants will be located at either end and near the center of the road. It is expected that the company will start with 100 20-ton cars and six electric locomotives, similar to the type in use in the Baltimore and Ohio tunnel at Baltimore.

The company has been incorporated under the laws of the Hawaiian Islands, and is capitalized at $3,000,000, the majority of the stock being held by Americans. Among the incorporators of the company the following names are given: Jandon Browne, Philadelphia; Herbert B. Gehr, Chicago; Francis M. Swanzy and Thomas Rain Walker, Honolulu; Gardner K. Wilder, judge of the Circuit Court at Hilo, and W. C. Gardner, Honolulu, president of the Hawaiian Senate.

CONVENTION ANNOUNCEMENTS.

Mr. J. H. Cooke, western manager for the Buckeye Electric company and the Jandus Electric company of Cleveland, O., will attend the railway convention in the interest of the Buckeye incandescent and the Jandus enclosed arc lamps.

Eugene Munsell & Co. and the Mica Insulator company will make a combined exhibit at the convention, having engaged a space of 200 square feet near the entrance. The exhibit will consist of mica in its natural state and in its various forms for electrical insulation, also stamped-mica segments and washers, both India and amber. Very large specimens of mica will be shown, which will be of interest to all electrical engineers and street-railway managers. The exhibit of the Mica Insulator company will consist largely of micanite rings, segments, tubes, troughs, cloth, paper, etc. The exhibit will be in charge of Mr. Charles E. Coleman, who has charge of the western business of these firms. The companies' Chicago offices are located at 117-119 Lake street, where the electrical fraternity will be welcome during their stay in Chicago.

Consumers desirous of trying renewed incandescent lamps, or sellers of burned-out lamps, and manufacturers' agents desirous of securing a new specialty, will be interested to know that Manager George H. Smith of the Re-new Lamp company of Malden, Mass., will be in Chicago at the Great Northern Hotel or the Palmer House from about October 14th to 28th. Mr. Smith is making a western trip, stopping at several middle-state cities between Boston and Chicago, with the purpose of establishing agencies for the Re-new Lamp company. This institution started the business of renewing incandescent lamps about 1½ years ago, and has succeeded so well throughout its home territory in the East that it is the purpose of the management to branch out through the West. Mr. Smith has already under consideration the names of several desirous of securing the agency of the Renew Lamp company, with Chicago as a center, but as yet no decision has been made. In addition to establishing a western branch, Mr. Smith will, in all probability, seize this opportunity to advertise his business before the street-railway people at the convention. It is uncertain as yet whether the Renew Lamp company will make any exhibit at Tattersall's, but it is very probable that Mr. Smith will be on hand during the entire street-railway convention. After Chicago, Mr. Smith expects to visit St. Louis, Indianapolis, Cincinnati, Toledo and Cleveland.

There has recently been incorporated in Colorado a company known as the Pike's Peak Power company. Warren, F. M. and H. E. Woods are the incorporators. The capitalization is $1,000,000, and the company's operations will be carried on in the counties of Fremont, Teller and El Paso, with headquarters at Victor and a branch office at Colorado Springs. The charter gives the company the right to manufacture and generate electricity for mines, factories, reduction plants, railroads and irrigation canals, and to furnish power for domestic purposes.

CORRESPONDENCE.

New York Notes.

New York, October 14.—The prospects of a rapid-transit tunnel railroad for New York now look bright. Corporation Counsel Whalen has signed the contract as amended by the rapid-transit commissioners, and on Wednesday he sent it with a letter to President Orr of the commission. In the letter Mr. Whalen said that he still thought the contract in some respects objectionable, but in view of the urgent need of rapid transit and the vital necessity of prompt action he concluded to approve it. Now that the contract has been returned signed, the commissioners are in a position to go ahead with their part of the rapid-transit project, and it is expected that the board will be able to advertise for bids within a week or ten days. With reference to the use of the tunnel by the contractor for electric-light and power wires, it is said that under the terms of the contract the contractor can use the tunnel for any purpose whatever, so long as he does not interfere with the maximum carrying capacity of the railroad running through it. Chief Engineer William Barclay Parsons, who will have full direction of the construction of the tunnel, is reported as stating that the tunnel will be built for railroad purposes, and not for electric-lighting, steam-heating or other outside schemes. He said that there might be considerable space left in the tunnel which the contractor could put to his own use, but it would not be so extensive as a great many people imagined. He thought the city could build a subway in connection with the tunnel work for its own benefit, and that it would be immensely profitable in time.

Corporation Counsel Whalen has sent a communication to the Richmond Borough Board, in which he states that he has advised Comptroller Coler that he can legally settle the claims of the company for the lighting already done under the contracts. It is expected that the comptroller will soon act upon Mr. Whalen's advice and that the matter will be settled to the satisfaction of all concerned.

M. L. G.

Michigan News.

Detroit, October 13.—The City Council of Monroe has granted a 30-year franchise to Jackson & Harrah of Detroit, to operate an electric road between Monroe and Toledo, the work to be commenced not later than November 15, 1899, and the road to be completed by August 1, 1900. They also have an option on a line to Detroit, to be completed by August 1, 1901, the option to take effect if the other road is completed on time.

The work of paralleling the Michigan Central railroad with electric roads is being pushed. The Kalamazoo-Battle Creek line is under construction; the franchises for the Battle Creek and Jackson line have been secured, and the Jackson and Ann Arbor line, it is said, will be completed as far as Dexter this fall.

The new Detroit, Rochester, Rome and Lake Orion railway, recently opened between Detroit and Rochester, crosses the Clinton River and the air-line division of the Grand Trunk railroad at Rochester on the finest trestle ever used on any western suburban electric railway. The cars on this trestle cross the river at an elevation of 45 feet above the surface of the water and 30 feet above the track of the railroad, affording passengers a fine view of the village of Rochester, the valley in which it is situated and the large sugar-beet factory which was built during the present year and which will soon commence operations. The remaining portion of the road is now graded and ties laid. Two miles of rail have been laid. Work on the division between Rochester, Lake Orion and Oxford will be completed by January 1st. The road has a franchise right to carry freight, and the postal authorities have requested a map of the route and terms for carrying the mails.

E. T. Crowe, who operates an extensive poultry farm just south of Adrian, has invented a device that will ring an electric bell every time a hen leaves the nest after laying an egg.

A survey is being made for the building of an electric railway between Allegan and Saugatuck. In the event of its construction power will be furnished by the big water power established on the Kalamazoo River, near Otsego. An electric line from Port Huron to Lexington is talked of.

A flywheel accident recently occurred at the Dearborn power house of the Detroit, Ypsilanti and Ann Arbor railway. Without the slightest warning two large flywheels broke, carrying devastation in their path. One wheel tore through a brick wall 20 inches thick; the other took an upward flight, tearing through the roof and crashing through the roof of the car barns 100 feet away.

The Detroit and Pontiac railway is the longest double-track suburban electric railway in the world, and almost the only one in the United States that is double-tracked throughout, insuring speed and safety. The cars are of the most modern style, comfortable, clean, bright and cheery. Every precaution is taken for the safety of passengers in the way of air brakes, extra-heavy trucks and car floors stronger than a Pullman car. The double-tracking of the road was finished during the past summer, which means that there is no wearisome waiting on switches for a car. A ride over the road through the village of Highland Park, Royal Oak township and village, the village of Birmingham, the townships of Bloomfield and Troy and the city of Pontiac is one of the pleasantest this part of the country affords. The road also passes the famous Log Cabin, now in Palmer Park. It is rather a new enterprise, inaugurated in 1894 by Detroit capitalists and opened through for excursion business in 1898. The officers of the road are George Hendrie, president; Stephen Baldwin, vice-president; Strathearn Hendrie, general manager and secretary.

J. H. G.

Northwestern Notations.

Minneapolis, October 14.—The Citizens' Traction company is pushing work on the extension in Neenah, Wis., to Riverside Park. Negotiations have been opened for the purchase of the strip of track on Main street owned by the Fox River Valley Electric company, which has been the cause of some differences.

Negotiations have been opened by G. V. Williams of St. Louis for the purchase of the electric-light and waterworks system in Marshall, Minn. Mr. Williams proposes, if successful in making the deal, to expend $15,000 in improvements.

The East Shore Electric Railway and Light company has been incorporated at Kaukauna, Wis., with $25,000 capital stock. The purposes of incorporation are very broad and include the manufacture and distribution of electric power for all purposes, building and equipping all kinds of railways for electric traction, transportation of passengers and freight, and building telephone and telegraph systems.

The Twin City Rapid Transit company will fence its line from Wildwood to Stillwater, Minn. The interurban cars from St. Paul will run very rapidly, and it is feared accidents will happen if the tracks are not fenced.

The Western Union office at Crookston, Minn., has received notice that henceforth messenger service will be furnished by the A. D. T., and the messengers have been transferred to that company.

The state board of electricity received 66 applications for license at its recent session in St. Paul. Nearly all were in business when the law was passed, but there were two candidates for examination. Those who were in business prior to the passage of the law are registered without examination.

The council decided not to purchase the electric-light plant at Aberdeen, S. D. The owners of the plant now contemplate removing it to the gas plant and use gas for fuel.

The new electrical power system being put in at Somerset, Wis., is expected to be ready to furnish power for the city of St. Paul by March 15th.

It is believed that the construction of the electric passenger and freight line between Ripon, Dartford and Green Lake, Wis., next summer is assured.

The electric-light system of Long Prairie, Minn., has received two new dynamos to replace two smaller ones now in service.

The Robinson & Cary company of St. Paul secured the contract to install an electric-light and water system for Lakefield, Minn.

The street-railway company of Fond du Lac, Wis., will extend its system to the new shops being established by the Wisconsin Central railway.

Local capitalists at Wausau, Wis., have asked a franchise for an electric railway and propose a line 10 miles long, to connect with the paper mills and with Rothschilds.

The Butte General Electric company of Butte, Mont., has offered the city 150 or more arc lights of 2,000 candle power for 10 years at $132 per light per year. The city is now paying $144 per light for 137 lights. The company also offers one per cent. of its gross receipts so long as it is the only company furnishing light and power in the city.

There is a suspicion abroad that someone has been tampering with the storage-battery system of the electric elevators in the courthouse at Minneapolis. It is said that the liquids in the battery bath have been doped and the machinery tampered with. This would explain why the storage system has given out so much sooner and has developed so much less power than it was expected to do. An investigation is possible. The contract has been awarded for a new storage battery to the Electric Storage Battery company of Philadelphia, at $8,600.

The Stevens Point (Wis.) Lighting company has recently released itself from mortgages amounting to $51,500, which, with accrued interest, amounted to $60,000.

The Edison Electric Illuminating company of Spokane, Wash., has been seriously delayed in getting its new plant installed by the inability of manufacturers to deliver goods. Machinery which was to have been started upon July 15th is now promised to start on October 15th.

A council committee in St. Paul estimates the cost of electric-lighting plant of 1,000 to 2,000 arc-light capacity, 2,000 candle power, at $250,000.

The city of Stillwater, Minn., has taken bids for electric street lighting. It was thought there would be active competition between the Apple River Power company and the Gas and Electric company of Stillwater. The former, however, sent word that it could not put in a bid, and the latter's bid was about $1,000 more than its previous bid, which was rejected. Now there is indignation and talk of a municipal plant.

The council of Council Bluffs, Ia., has received propositions for electric-light plants, the figures ranging from $61,000 to $153,000, under different conditions. The lowest figure is from the present company, which is also willing to submit to having its plant appraised by a disinterested board.

Lea & Johnson are about to install an electric-light system for New Richland, Minn.

The electric-light company of Boone, Ia., has made the council a proposition to furnish 80 arc lights of 1,200 candle power for five years at $70 a light per annum. The company now furnishes 34 arcs of 2,000 candle power at $90 each per annum.

An electric railway is being surveyed from Mineral Point, Wis., to Highland via Dodgeville. The work is to be begun at once and rushed to completion.

The press at Taylor's Falls, Minn., urges the development of the falls in the St. Croix River at that point for electric power and light.

September 29th was "Trolley Day" in Des Moines, Ia. On that day prominent ladies of the city had charge of the street cars, collected the fares, etc. The regular motormen were in charge of their departments, but otherwise the ladies did the work. The proceeds amounted to $800 and were devoted to the Home for the Aged.

W. N. Wegg of the Chicago Electric company was drowned near Perham, Minn., while on a duck-hunting trip. It is supposed he stood up in the boat and shot, the kick of the gun sending him overboard. The remains were sent to Monroe, Wis.

Both electric-light companies of Des Moines, Ia., are reported to be overburdened with business and claim to be taxed to their utmost capacity.

R.

Niagara Falls.

Niagara Falls, N. Y., October 14.—The Niagara Falls Power company has announced its intention to lay a power conduit in the city of Niagara Falls from its power station to the upper steel-arch bridge. Cables for the transmission of power to the Canadian side will be placed in the conduit.

Two new turbines and four new generators are to be installed by the Niagara Falls Hydraulic Power and Manufacturing company. When these turbines are in position they will be supplied with water from the big penstock, and they will complete the turbine equipment designed to be fed from this penstock, the total being five in all. It is stated that R. D. Wood & Co. of Philadelphia will make the wheels, and that the General Electric company will make the generators.

Application has been made to the Ontario government for a right to construct an electric railway from Chippawa, Ont., to Welland, Ont., the interested persons living in Niagara Falls and Fort Erie, Ont. Chippawa is about two miles above the falls, while Welland is about 12 miles distant. If the franchise is obtained the road will do a passenger and a freight business. Chippawa is on the upper Niagara River, and boat connections will be made there, while connections will also be made at Welland with craft on the Welland Canal.

In Buffalo the International Traction company has set men in large numbers to work laying a double track through Utica street from Fillmore avenue to Rhode Island street. Work commenced soon after midnight on a Sunday. A certificate of necessity had been granted by the railroad commissioners, a franchise from the city had been obtained, the consents of a majority of the property owners were given, and the Board of Works had approved the company's plans. Still there was opposition, and, in order to avoid it, it was deemed best to work Sunday.

D.

PERSONAL.

E. P. Roberts of the engineering firm of E. P. Roberts & Co., Cleveland, was a recent visitor in Chicago.

A dispatch to the Chicago Record from Milwaukee, dated October 12th, says: "Henry C. Payne, who has been very active in arranging for the reception of the president in this city, was to-night prostrated while returning to his home about six o'clock. The attack came while he was passing Meadow's drug store, at the corner of Van Buren and Biddle streets, and he was at once taken into the store. He was attended by Dr. Wingate, and was soon after removed to his home. It was reported this evening that he was much improved and out of danger." Mr. Payne is a prominent street-railway man. He is vice-president of the Milwaukee Electric Railway and Lighting company, and in 1893-94 was president of the American Street Railway association.

Ira A. McCormack, late general superintendent of the Brooklyn Rapid Transit company and one of the prominent street-railway men of the country, has resigned his place in Brooklyn to become vice-president and managing director of the Syracuse Rapid Transit Railway company. Mr. McCormack has been an active factor in the upbuilding and successful operation of the Brooklyn system, with which he was connected for four years. It is hinted that since the final consolidations of the street-railway systems in Brooklyn the company is pursuing a policy of salary-cutting, along with other economies, and that this may explain Mr. McCormack's retirement. Assistant Superintendent W. W. Wheatley succeeds to the position lately held by Mr. McCormack.

ELECTRIC LIGHTING.

Barton Heights, Va., will erect an electric-light plant and water works at a cost of about $20,000.

A recent election in Greenport, L. I., resulted in favor of issuing $10,000 worth of electric-light bonds.

Recent elections held in Lehi City, Utah, and St. Louis, Mich., resulted in carrying propositions for the issuance of electric-light bonds for $6,000 and $10,000 respectively.

The Miami Power and Water company has been incorporated at St. Augustine, Fla., with a capital stock of $50,000, to construct and operate an electric-light plant and waterworks.

The construction of a city electric-light plant has been recommended in Augusta, Ga., to be put in operation when the present lighting contract expires on July 1, 1902. The estimated cost of the plant is $101,000.

The Supreme Court of Pennsylvania has decided that electric-light companies in that state are manufacturing corporations for all purposes except taxation, but they do not fall within the clause exempting manufacturing corporations from the state tax on capital stock. The higher court holds that electric-light companies are of a quasi-public nature and that the tax laws should be construed strictly. The opinion was on the appeal of the Keystone Electric Light, Heat and Power company, which purchased the property and franchises of the People's Electric Light, Heat and Power company of Gettysburg and reorganized it. The attorney-general instituted quo warranto proceedings on the ground that there was no authority for the reorganization of an electric-light company on the purchased franchises of a defunct company through a judgment sale. Under the decision just rendered the Gettysburg company has the right to reorganize under its old charter.

ELECTRIC RAILWAYS.

The Mankato Traction company, recently incorporated in Minnesota, will operate an electric railway between Mankato and Le Sueur, Minn., passing through the villages of Lake Washington and Cleveland.

A dispatch from San Francisco says that a bill of complaint will soon be filed in the United States Circuit Court in that city as the commencement of an important patent suit. Binson Bidwell, who claims to be the original inventor of the system by which all the electric roads of the country are operated, is the principal complainant. The Market Street Railway company of San Francisco, the Thomson-Houston Electric company of Connecticut and the General Electric company of New York are made defendants, and it is said that similar suits will be commenced in several states. Bidwell charges that the defendant corporation, as well as others, has made immense profits out of his inventions, and the suits in question are based upon infringement of his patents. He prays for a royalty of 40 per cent. on the net profits.

AUTOMOBILES.

Consul Roosevelt writes from Brussels, Belgium, that a royal decree has approved the resolution of the Provincial Council of Brabant, fixing an annual tax, after January 1, 1900, on automobiles of whatever system. The rate is fixed at 50 francs ($9.65) for an automobile weighing 400 kilogrammes (880 pounds) or more, and 20 francs ($3.86) for one weighing less.

Mr. and Mrs. John D. Davis, who left New York in an automobile July 13th for a tour across the continent, with San Francisco as their destination, reached Chicago on October 10th, and are now stopping at Hotel Del Prado. The series of accidents that has delayed them continuously was supplemented by the breaking of the rear axle of the vehicle as they entered Chicago, and consequently the automobile is now undergoing repairs. It is said that out of the three months spent on the road but 116 hours were consumed in actual travel. The plucky automobilists are determined to keep on to the coast and expect to leave soon for Denver.

"The Automobile," a toast suggested by the growing usefulness of the horse's successor in the collection and distribution of city mails, was responded to by Samuel G. Dorr, postmaster in Buffalo, N. Y., at a banquet tendered to Postmaster Gordon of Chicago during the recent Fall Festival. Mr. Dorr was reported as saying during his toast: "I am impressed with the idea that the automobile can do the work of six horses at the cost of keeping one. It may not always be possible or advisable to so arrange the work as to realize such a percentage of advantage, but if a locomotive can do the work of a thousand horses, and an electric car can do the work of 50 horses, I am willing to stand here and say that a good automobile can do the work of six horses at the same expense that the care and keeping of one good horse usually requires."

The Continental Automobile company of New York has been incorporated under the laws of New Jersey, with a capital stock of $8,000,000, of which sum $3,500,000 is six per cent. preferred stock. This company is said to have acquired, by purchase, the business of the following-named corporations: The Winton Motor Carriage company, Cleveland, O.; the Manhattan Oil Motor company, Jersey City, N. J., and the National Motor Carriage company, New York, N. Y. It owns and controls 49 domestic and foreign patents covering the use of gasoline, kerosene and petroleum as applied to motors or engines for automobile, marine and stationary-power uses. The directors of the company are Hon. Anthony Higgins, ex-United States senator, Wilmington, Del.; William H. Bulkeley, director United States National Bank, Hartford, Conn.; William H. Lake, New York; W. H. Nixon of the Martin & W. H. Nixon Paper company, Philadelphia, Pa.; Charles T. Welles, president City Bank of Hartford, Hartford, Conn.; George H. Brown, secretary Winton Motor Carriage company, Cleveland, O.; A. M. Jordan, president Atlantic City Sewerage company, Atlantic City, N. J.; W. C. Hendrickson, Belle Meade, N. J.

PUBLICATIONS.

An interesting booklet is issued by the International Correspondence Schools of Scranton, Pa. It contains illustrations and descriptions of some of the different departments of the work, and also facts and figures regarding the schools and the courses offered.

A bulletin descriptive of direct-current multipolar motors has been issued by the Bullock Electric Manufacturing company of Cincinnati. These motors are adapted to be placed upon ceiling, side-wall or floor, and may be either directly connected, belted or geared to the work.

POWER TRANSMISSION.

The initial trial of the new power line of the Yuba Electric Power company, whose plant is situated on the North Yuba River, some 65 miles from Sacramento, Cal., was made in that city on September 5th, and resulted successfully. It was the first installment of 1,000 horse power sent by the Yuba company under contract with the Sacramento Electric, Gas and Railway company of that city, and supplemented power already used, transmitted there from Newcastle and Folsom. Under contract 4,000 more horse power is to follow. Aluminum wire is used exclusively for the transmission, also for the telephone system in conjunction therewith.

TRADE NEWS.

The Crefeld Electrical Works of Saylesville, R. I., have been purchased by the American Electrical Works and removed to a substantial new three-story brick building, 130 feet by 60 feet, adjoining the American Electrical Works' factories at Philipsdale, R. I.

W. T. Osborn & Co. of Kansas City are nearly through with the wiring of the new Kansas City government building and the Kansas City High School. They are installing plants for the Bond Shoe company of that city and the Kansas City Stock Yards company.

The electrical illumination of Siegel, Cooper & Co.'s big store in Chicago during the recent Fall Festival was a striking exhibition. The Western Electric company recently installed for this firm a 125-kilowatt direct-current machine and a 40-light arc dynamo, the entire output of which was used for the exterior illumination of the store.

The Triumph Electric company of Cincinnati asks the electrical trade to note that the United States Court of Appeals has affirmed the decision of the lower court in favor of the Triumph Electric company, in the suit brought by the Westinghouse Electric and Manufacturing company. The Triumph people make railway generators, either belted or direct-connected.

The New Era Iron Works company of Dayton, O., manufacturer of the well-known New Era gas and gasoline engines, has recently purchased a new plant, which it is now remodeling and equipping with all the latest improved machinery. The demand for the New Era is said to have been such as to compel this action. By January 1st, the capacity of the plant will have been doubled, and the company will then have one of the finest gas-engine factories in the United States.

Hugo Reisinger of 11 Broadway, New York, the importer of the celebrated Electra carbons, reports having received a large order for searchlight carbons from the United States government, to be used for the navy, as well as the United States lighthouses. The government expert, who has given these carbons an exhaustive test, testifies to their high quality and efficiency, stating that the Electra searchlight carbons were the best they had ever been using, and expressed himself in the highest terms as to the results he obtained from them.

Not the least interesting fact in the development of electricity is the tendency of many American boys to enter with enthusiasm into the subject and experiment with the various electrical appliances, both entertaining and practical, that are found on the market to-day. The steadily increasing demand for these goods has caused several large electrical concerns to create special departments for their manufacture. The Ohio Electric Works of Cleveland, O., are prominent among these firms on account of the variety and prices of their electrical specialties. They carry a full and complete line of general supplies, and prompt shipment of orders is always assured. Their descriptive catalogue will be forwarded upon request.

Under date of October 5th Professor R. C. Carpenter of Cornell University writes the following in regard to experiments with Cling-surface: "Later tests of the use of Cling-surface on belting substantiate in every particular the statements made in my report of April 17th. They also indicate higher efficiency of transmission and less loss of power in the case of belts treated with Cling-surface than in the case of belts not so treated, when working under the conditions prevailing at the time of the earlier test. This is due to the fact that the slipping of a belt causes considerable loss of power, the power so lost passing off in heat. The use of Cling-surface reduces the slipping and consequently reduces the loss of power occasioned by the use of belts that slip. During the past six months I have had occasion to observe the practical use of Cling-surface in a number of instances. In all such cases Cling-surface has improved the belts by softening them, and as far as I can determine in the limited time (seven months) tends to preserve the leather of which they are constructed."

The American Steel and Wire company, contrary to the impression which might be created by its name, is by no means confined to the production of iron and steel wires or their products. By the absorption of the Washburn-Moen Manufacturing company, the larger organization inherited one of the world's most important manufactories of bare and insulated copper wires in various forms and for all electrical purposes. With the immense plant at Waukegan, Ill., only 35 miles north of Chicago, at which much of the copper wire is produced, the American company enjoys exceptional facilities for catering to the wants of the trade in the West, giving, as it does to their organization the same prestige in occupying the western field that is enjoyed by the Washburn-Moen department at Worcester, Mass., in eastern territory. In the production of electrical wires, bare and insulated, no name has ever stood higher than that of Washburn-Moen. At the Waukegan plant especial attention is given to the manufacture of the well-known Extra BB, BB, and Steel telephone and telegraph wires and copper wires for electric-lighting and street-railway plants in all their various forms. In the production of copper rail bonds, either solid or flexible, the prestige of the Washburn-Moen name has been added to since the formation of the American Steel and Wire company, and the output of solid and flexible Crown bonds in a variety of patterns and for adjustment to the rails in various positions has been very large. This is equally true of the manufacture and sale of copper trolley wire, in which this company has earned a commanding position. In the department of insulated wires, the entire line, including every form of magnet wire, office and annunciator wire, weatherproof wire, feeder wires, lead-encased wires and cables, and submarine cables is thoroughly covered, the rubber-insulating, taping, braiding, lead-encasing, armoring and weatherproofing being carried on under the supervision of the most expert, scientific skill and experience that can be secured. The general offices of the company are located in the Rookery, Chicago, with branch offices in New York, Worcester, St. Paul, St. Louis, Cleveland, Denver, San Francisco and other cities.

BUSINESS.

The Central Electric company, Chicago, is well pleased with its sales of electric-railway material for fall installation. The overhead products of the Central Union Brass company, which the Central Electric company supplies from Chicago stock, as general selling agent, are said to be daily gaining more friends.

The machinery and electrical department of the United States commission to the Paris Exposition has purchased from the Ball Engine company, Erie, Pa., a 350 horse power tandem-compound engine, arranged for direct connection to a Bullock generator, to be used as a working exhibit in the machinery annex at Vincennes.

The Electric Appliance company, Chicago, has issued a pamphlet giving description and prices of the Gutmann recording wattmeter, for which the company named is western selling agent. The Electric Appliance company has a reputation of pushing the sale of new specialties only when it is assured that the latter are electrically and mechanically excellent.

The Jandus Electric company calls the attention of street-railway managers to the Jandus series-multiple lamps for railway and power circuits. This lamp is guaranteed to perform satisfactorily two in series on 200 volts and six on 600 volts. The average repair cost a lamp per annum for the past six years is said to be 25 cents. Catalogue, prices and further information will be furnished on application to the Cleveland or Chicago office.

Gates & Randolph of Chicago report excellent business, having sold 30 complete electric plants during the last month. Realizing the extensive application of the electric-motor carriage, they have also taken the agency of the Indiana Bicycle company of Indianapolis, Ind., which manufactures the Waverly automobiles in all styles. A number of these carriages will be on exhibition at the street-

railway convention. This firm's electrical knowledge will come into good play in the sale of these vehicles.

The Buckeye Electric company's street-railway lamp commends itself for this branch of work for two excellent reasons. First, the unusually low percentage of renewals; second, the unusually high efficiency in illumination. For 600 hours' average burning an average of 16 candle power is maintained. Every 10 hours the Buckeye factory delivers 5,000 finished Buckeye lamps to the trade. Catalogue, price, etc., may be had upon inquiry at the Chicago office, 1537 Monadnock building.

The Western Electric company has installed three 75-kilowatt generators of the direct-connected type in the large dry-goods house of William Donaldson & Co. of Minneapolis, Minn. The dynamo and engine room is easy of access, and it is the intention that customers shall be invited to visit the room in which the machinery is installed. William Donaldson & Co. consider that a first-class electric-light plant, well installed and kept in good order, will always be an interesting sight to many of their customers, and they extend a general invitation to everyone desiring to see a modern plant to visit their store.

Street-railway men are reminded that the Swarts Metal Refining company of Chicago makes a specialty of refining and reclaiming old brass and copper. The Swarts company pays the highest market price for scrap copper wire, rail bonds and other worn-out apparatus containing copper or brass. The Swarts company has done business with almost every prominent electric-light and electric-railway company in the United States. Users of electrical apparatus have been enabled to realize considerable sums on odds and ends of copper wire which can be found around their plants, and those who have not realized on this apparent waste may find it to their advantage to communicate with the Swarts company, which, through the efforts of President Seymour Swarts, has built up a large business.

The Bullock Electric Manufacturing company of Cincinnati reports sales for the month of September involving 61 machines, ranging in size from three to 150 kilowatts. Among the more important were 15 engine-type generators for United States army transports and 10 50 horse power motors, to operate at 200 revolutions per minute, for Dick, Kerr & Co. of London, England. Several "repeat" orders were received, among them being the following: Maryland Steel company, Baltimore, Md. (third order); Consumers' Park Brewery, Brooklyn, N. Y. (third order); Atlas Cement company, Northampton, Pa. (fifth order); Missouri Lead and Zinc company, Joplin, Mo. (third order). When representative concerns, such as those named, find it to their advantage to add, more than once, to their equipment of Bullock apparatus, it can mean but one thing, and that is that the machines have given perfect satisfaction. A new bulletin, No. 2235, just issued by the company, describes Type "N" motors. This is the first bulletin of the standard six by nine-inch size which has been issued. It is believed that those interested in electrical literature will appreciate this reduction in size, as the new bulletin is more readily filed than the larger pamphlets. It may be had by addressing the company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 10, 1899.

634,467. Electrical Influence Machine. Karl S. Lemström, Helsingfors, Finland. Application filed March 4, 1899.

The machine has in combination two drums, one arranged in the other, means for revolving these drums in opposite directions, a fixed insulated spindle formed of two metal pins or journals insulated one from the other by an intermediate block of insulating material and two pairs of metallic combs, each pair supported by one of the metallic ends of the spindle.

634,487. Electrical Indicator. Montgomery Waddell, New York, N. Y. Application filed January 10, 1899.

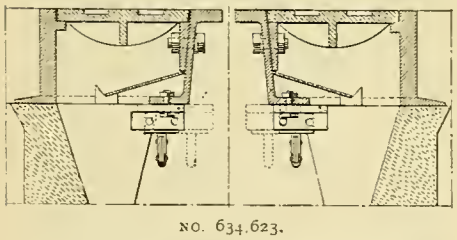
In the apparatus described the level of a column of liquid indicates the condition of the current flowing, and an air supply acts upon the liquid to change its level. Means are provided whereby the electric current varies the pressure of the supply of air.

634,488. Electrical Indicator. Montgomery Waddell, New York, N. Y., and Charles Legrand, Westfield, N. J. Application filed February 18, 1899.

This indicator combines a column of liquid whose level indicates the condition of the current flowing, an air supply acting upon the liquid to change its level, a valve controlling the pressure of the supply, a counterbalanced weight resting upon the valve and means whereby the pressure of the weight upon the valve is varied in accordance with variations in the current flowing.

634,541. Electric Starting Device for Gas Engines. John W. Raymond, Oil City, Pa., assignor to the Standard Automatic Gas Engine company, Oil City, Pa. Application filed November 17, 1898.

In combination with the working cylinder of an explosive engine are provided a powder chamber connected with the cylinder and with one pole of an electric generator and adapted to receive a charge of powder, and an electrode in the chamber connected to the other pole of the generator and movable toward and from the terminal of the chamber for producing a spark.



NO. 634,623.

634,542. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, New York, N. Y. Application filed August 13, 1898.

An axle of a railway car is provided with a driving pulley which is connected to the pulley of a dynamo secured to the car above by means of a driving belt.

634,568. Insulating Support for Electric Wires. Carroll N. Beal, San Francisco, Cal. Application filed November 17, 1897.

A main-line insulator and support is described which consists of a screwed shank or other suitable means of attaching the insulator in a pendant position, a central member to which the main wire is attached, and surrounding this member one or more guard flanges, the outer one provided with deflecting ledges or projections to direct dripping water from the main wire.

634,575. Telephone System. Edwin W. Ham, Worcester, Mass., assignor to Plummer, Ham & Richardson, Worcester, Mass. Application filed June 13, 1898.

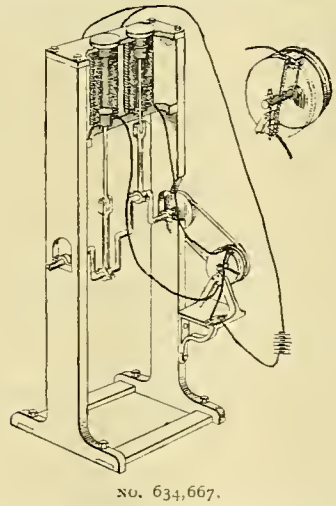
In a telephone switchboard are combined a plurality of circuit-making plungers or push buttons, each having an inclined stop section, and a longitudinally movable detent plate co-operating with the push buttons, the engaging surfaces of the push buttons and the detent plate being chamfered or inclined in the opposite direction to the stopping section of the push buttons, whereby when a push button is operated, previously operated push buttons will be released before the push button being operated comes to its operative position.

634,623. Conduit Railway. Myron D. Law, New York, N. Y., assignor to the Love Electric Traction company, Chicago, Ill. Application filed January 12, 1899.

Features of the railway are a conductor-support consisting of a base plate attached to the foot of the slot rail and capable of lateral adjustment toward and from the center of the conduit, and a slide attached thereto capable of longitudinal movement and carrying the electrical conductor. (See cut.)

634,666. Electric Brake. George H. B. Hooper, Toronto, Canada. Application filed June 8, 1898.

A brake for wheels is described comprising a bar magnet of uniform cross-section throughout, having the wound portion formed on a core, the arc of which is that of a circle less than that of the rim of the wheel to which it extends, pole ends extending entirely outside such arc and formed on arcs concentric to the perimeter of the wheel and having their inner arc-shaped sides disposed to contact with the wheel.



NO. 634,667.

634,667. Electromagnetic Cylinder Engine. George H. B. Hooper, Toronto, Canada. Application filed July 31, 1897. Renewed March 28, 1899.

Vertical standards are combined with cross bars, solenoids held between the cross bars, removable cores having rods depending therefrom, a crank shaft extending between the standards below the solenoids, rods connecting the cranks thereon to the core rods, a commutator, a pulley on the crank shaft, a drive connection from the pulley to the commutator and an electric source of supply and leads. (See cut.)

634,744. Valve-operating Device and Alarm. Albert Borden, St. Louis, Mo. Application filed February 9, 1899.

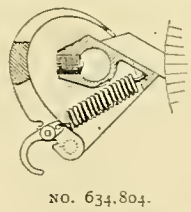
An electrically operated alarm bell is connected to contact points on a fulcrumed arm which is a part of the valve-operating device.

634,759. Crossing for Underground Conduits for Electrical Conductors. Victor Koch, Scranton, Pa. Application filed June 17, 1899.

A crossing for underground conduits is described which comprises longitudinal and transverse trough sections, a base between the sections and with which the sections are in engagement and an arched cross-shaped cover section fitting upon the upper edges of the trough sections.

634,766. Electrical Binding Post. William Roche, Jersey City, N. J. Application filed August 22, 1899.

The binding post has a core screw-threaded exteriorly and slitted longitudinally from the end inward, the screw-thread extending inwardly beyond the inner end of the slot, and a clamp or nut constructed to screw on the core and having a funnel-shaped interior enlargement at one end of its bore.



NO. 634,804.

634,767. Volt and Ampere Meter. James D. Ross, Victoria, Canada. Application filed February 18, 1899.

Features of the meter are two air-tight cylinders, a capillary tube connecting the two cylinders, a liquid in the tube, a gauge having fixed relation with the tube, and means for electrically equalizing or varying the pressure in the two cylinders.

634,804. Brush Holder for Commutators. William Cooper, William H. Warren and Charles A. Mudge, Cincinnati, O., assignors to the Bullock Electric Manufacturing company, Cincinnati, O. Application filed May 18, 1898.

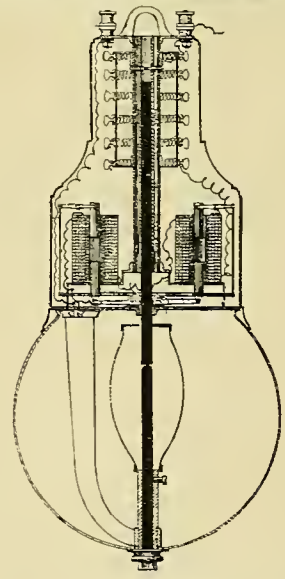
With a commutator are combined a block of carbon or other electrical conductor, one of its beveled ends lying against the commutator, a flat and adjustable conducting plate upon which the block rests and is movable, a pivoted bifurcated arm whose free end bears against the other end of the brush, and provided with notches in its bifurcations, a thumb-piece provided with pawls which engage in the notches, and a coiled spring whose normal tendency is to hold the thumb-piece in contact with the arm and one end of the arm against the brush. (See cut.)

634,811. Electric Meter. Paul Eibig, Berlin, Germany, assignor to Emanuel Bergmann, Berlin, Germany. Application filed February 10, 1899.

The meter includes a stationary coil or coils, oscillating levers carrying coils arranged to swing in the magnetic field of the stationary coil or coils, a directing or resistance mechanism tending to return the levers to a predetermined position, and a separate clockwork connected with each of the levers.

634,816. Electric Block-signal System. Selden H. Hall, Buffalo, N. Y. Application filed February 20, 1899.

The system comprises a one-wire main circuit actuating opposite signals at both ends of the block, magnets in the circuit for actuating the signals, energizing and de-energizing magnets for opening and closing the main circuit, automatic means for controlling the magnets, and a contact device actuated by an approaching car or engine.



NO. 634,849.

634,832. Brake and Power Apparatus for Electrically Driven Vehicles. William E. Pearson, Boston, Mass. Application filed March 4, 1899.

An apparatus is described which combines with a brake shaft having a pinion gear, a slide adapted to be operated by the pinion gear, a rack upon the slide adapted to engage with and operate the electric-controller mechanism, a pin on the slide engaging with a narrow opening in a sliding plate, the sliding plate having a rack adapted to engage with a pinion on the brake shaft and to be operated by it, whereby the motion of the sliding plate is at intervals communicated to the slide.

634,848. Device for Preventing Electrolysis in Pipes. Clinton S. Coursen, Springfield, O. Application filed April 1, 1899.

The device comprises a packing having an inturned flange at one end, an interior annular groove adjacent to the flange, and one or more external annular projections therefrom.

634,849. Arc Lamp. John A. Davies, Cleveland O. Application filed October 29, 1898.

Carbon-controlling mechanism for an arc lamp is described which has, in combination with a solenoid provided with upper and lower cores independently movable therein, a clutch constructed to raise the carbon and intermediate mechanism connecting the cores with the clutch, whereby both the cores work in unison to raise the carbon. (See cut.)

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, OCTOBER 28, 1899. No. 18

John M. Roach, President American Street Railway Association.

In selecting Mr. John M. Roach as its president the American Street Railway association honored Chicago and secured as its executive a practical street-railway operator of thorough and extended experience. Born near Marietta, O., on January 30, 1851, Mr. Roach has been connected with the North and West Side surface roads in this city since he was 21 years of age, and has gained all his experience in Chicago and with one system—that so closely associated with the name of Mr. C. T. Yerkes, who is one of his closest friends.

Mr. Roach has made his way from the bottom of the ladder in the 27 years that have elapsed since, on October 7, 1872, he secured employment as a conductor for the North Chicago Street Railroad company, now a part of the great system of the Chicago Union Traction company, of which Mr. Roach is the general manager. The young man had knocked about the world quite a bit before he settled down to the street-railway business. He had no influential friends to help him, but he was honest, capable, self-reliant and industrious and had early acquired a considerable fund of valuable information. Wherever possible he improved his knowledge of machinery and made a special study of the development and utilization of power. At that time power transmission as known to-day was undeveloped, but in all the work along that line Mr. Roach was greatly interested. He has kept in touch with the advancement that has been made up to the present time, and is thoroughly familiar with the merits and failings of the respective systems, especially as applied to street-railway work.

Advancement came rapidly to the young employe. After a short term as conductor, Mr. Roach was made cashier of the North Side company. When Charles T. Yerkes secured control of the property he at once recognized Mr. Roach's ability and retained him in the service. With the extension and development of the Yerkes system Mr. Roach's duties increased, and when the time came for the introduction of mechanical power to supersede the old horse cars the knowledge he had acquired upon this subject proved valuable to the company. After the cable had been introduced upon the Clark street line, Mr. Roach gave personal supervision to every detail of operation, and when the cross-town and branch lines were equipped electrically these, too, received his personal attention.

Upon Mr. Parsons' retirement from the West Chicago Street Railroad company this property was also placed under Mr. Roach's management, and to-day he is in control of the operation of one of the largest street-railway systems of the country, that of the Chicago Union Traction company, which leases the North and West Side systems, with their 320 miles of track, 2,000 cars, 8,000 men and 35,000 horse power in power stations. At the time of the consolidation of the North and West Chicago Street Railroad companies and the retirement of Mr. Yerkes, a few months ago, Mr. Roach was second vice-president of the North Side company and vice-president and general manager of the West Side company. He is now general manager of the Chicago Union Traction company. Mr. Roach is financially interested in several of what are known as the "Yerkes companies," but is better known as a street-railway operator than as a street-railway financier.

Mr. Roach has seen the whole development of the cable and electric-railway system in the streets of Chicago. He has supervised many experiments with other systems on the North Side lines—storage batteries, electric conduits, gas motors, "soda motors" and compressed-air cars, but none of the trials has resulted in the permanent use of any of the novelties tested to any great extent, although a loop was for some time operated on the Love conduit system several years ago, and a few compressed-air cars are now operated at night.

Since 1888, when Charles B. Holmes, then president of the Chicago City Railway company, filled the office, no Chicago man, till the honor came to Mr. Roach, has been president of the American Street Railway association, although Robert McCulloch, now general manager of the Chicago City company, is an ex-president, having been elected while a resident of St. Louis.

JOHN M. ROACH.

Monongahela Light and Power Company.

Among the exhibits of the Westinghouse company at the street-railway convention were some new and improved machines for the Monongahela Light and Power company. The plant of this company will be the most complete in the Pittsburg district, it is said, embodying every up-to-date appliance and the most recent applications of electrical science.

The month of December should see the plant in full operation, supplying power for the Monongahela Traction company, with its allied branches, and furnishing light to the towns of Braddock, Homestead, McKeesport, Duquesne and other points in that vicinity.

The building for the central power station at Rankin will be 95 feet by 333 feet, with an extension for coal storage to be completed later. The foundations are already finished, and the steam plant is expected very shortly.

The engines will consist of six pairs of the Corliss cross-compound design, each pair to be 1,000 horse power, under ordinary working conditions, but capable of exerting about twice that amount. The boilers will be of the water-tube type, equipped with Roney stokers. The electric generators are building by the Westinghouse Electric and Manufacturing company. There will be three 600-kilowatt, 500-volt machines, designed to furnish railroad power, three 750-kilowatt, quarter-phase alternators and 10 125-light, motor-driven arc-light units, with the latest switchboard improvements.

Condensers and pumps of modern types will be furnished, and coal and ash-handling machinery will be installed. The building will be of brick with steel structural work and truss roof. The cost of the plant will be $500,000, the power and electrical equipment costing $375,000. As soon as the new central station is completed, it will supersede four small plants now in operation, as fully 50 per cent. in expenses can be saved by centralizing the source of electric power. In constructing the foundations, future requirements have been taken into account, and the initial capacity of the plant can be doubled with very slight addition to the buildings.

In time it may be expected that plants of this kind will be numerous, transmitting light and power currents for cities and towns where now there are many small plants begriming the atmosphere. These large stations are naturally fitted with the very best appliances, including smokeless automatic stokers. Their economy will be better utilization of fuel, less friction and the supply of just the amount of energy required by the consumer.

Marconi and His Work.

Marconi has been the recipient of many social attentions in New York. His fellow-countrymen, especially, delighted to do him honor. Baron Fava, the Italian ambassador at Washington, gave a dinner early last week for him. The dinner was served in the Astor dining-room of the Waldorf-Astoria. Eight guests were invited and the occasion was entirely informal. Among those present were Signor De Vinci and several other members of the Italian embassy. On the next night Mr. Marconi was the guest of honor at a dinner given by the Italian Chamber of Commerce of New York. One hundred or more of the prominent Italians of New York were present. Mr. Marconi made a speech in Italian on "The Evolution of the Telegraph."

It is probable that the New York and the Massachusetts, under command of Admiral Farquhar, will be the naval vessels fitted for the forthcoming tests of the Marconi system for the use of the United States government. Orders have been sent to the New York navy yard to furnish long wooden spars for the experiments to the two vessels at the anchorage in the North River, and it is the expectation that the apparatus will be installed soon. According to the stipulations made by Marconi, wooden spars will extend the signal masts of each ship to a height of 150 feet above the water. No metal rigging is admissible within 15 feet of the top. Near the head of each mast a yard will be lashed, to one end of which there will be a rope to adjust the slant of the yard, the other end carrying the vertical wire. Admiral Farquhar will take the two ships to sea, with Marconi as his guest on the flagship New York. The two vessels will then cruise apart, in wide circles, for at least a week, and determine the trustworthiness of the system under varying conditions of weather and distances. Marconi is confident of maintaining communication constantly, so long as the distance between the vessels does not exceed 80 miles.

Marconi Before the Institute.

It is arranged that Mr. Marconi shall deliver an address on his space-telegraphy system, probably with experiments, before the American Institute of Electrical Engineers, at the rooms in New York, some time between November 1st and November 10th, the exact date being still unfixed. On the same evening the subject will be discussed at a meeting of the western branch of the Institute at the Technical Club in Chicago, the lecturer being Mr. A. V. Abbott. Secretary R. W. Pope of 26 Cortlandt street, New York, and Mr. R. H. Pierce, local honorary secretary, of 1409 Manhattan building, Chicago, are making the arrangements.

New York Electrical Society.

With a view to the more effective conduct of the work of the New York Electrical Society, the following-named committees were formed at the executive committee's opening meeting of the season of 1899-1900: Papers and meetings, Dr. C. A. Doremus, Stephen L. Coles; membership, F. A. Pattison, H. V. Henshaw; finance, Charles Blizard, Arthur Williams; constitution and by-laws, F. A. Pattison, Arthur Williams, H. A. Sinclair. These committees are already at work, and it is confidently predicted that in such hands the affairs of the society will attain a prosperity even exceeding its fine record of the last two years.

Work is under way upon the extensions of the electric lines to be built by the Metropolitan Street Railway company of Kansas City, Mo. The extensions represent an outlay of about $250,000.

AMERICAN STREET RAILWAY ASSOCIATION.

Without doubt the most successful convention of the American Street Railway association ever held was that of last week in Chicago. This statement holds true in relation to the size of the attendance, the sustained and intelligent interest in the daily sessions of the association and the number and character of the exhibits shown. Estimates of the convention attendance—not counting the people who paid admission to view the exhibits, but merely computing those who had business with the association or at the exhibition—vary from 1,800 to 2,200, so that it seems safe to say that 2,000 persons were drawn to Tattersall's during the four days' meeting and exhibition, in addition to employes of local street-railway companies and those of the general public who went as spectators merely.

But four papers were read, but these were intelligently and fully discussed. The large attendance at each day's session was an especially gratifying feature. There were few vacant seats in the hall at any time, and both President Sergeant and Secretary Penington were greatly pleased with the excellent attendance of members and commented upon it. The meeting-room of the Street Railway Accountants' association was also thronged every day. There was but one business session each day, and the afternoons and evenings were devoted to excursions and entertainments. These "social features" were greatly enjoyed and largely attended.

The exhibition of street-railway machinery and supplies was large and very interesting. It was held in the body of Tattersall's building, while the sessions of the two associations were held in rooms on the second floor, opening on the northern gallery.

Opening Business.

In opening the eighteenth annual meeting of the American Street Railway association on Tuesday morning, October 17th, President Charles S. Sergeant of Boston invited past-presidents and officers of the association to take seats on the platform, and introduced Mr. H. S. Taylor, the public prosecutor of the city of Chicago, who represented Mayor Harrison in welcoming the association to Chicago. Mr. Taylor made a pleasant speech, saying that the mayor fully appreciated the importance and value and dignity of the convention. President Sergeant, in turn, thanked Mr. Taylor and the mayor for their kind wishes.

The president informed the association that the executive committee had voted that any American elevated-railway company, as well as any surface-railway company, is eligible for membership. Invitation to join the association was extended, and the Pueblo (Colo.) Traction and Electric company, the Venice, Madison and Granite City Railway company of St. Louis and the Atchison (Kan.) Railway, Light and Power company responded. Other members reported since the last meeting are Aurora (Ill.) Street Railway company, Bridgeton and Millville (N. J.) Traction company, Chicago Electric Traction company, Montreal (Canada) Street Railway company, Oakland (Cal.) Transit company, Los Angeles and Pasadena (Cal.) Electric Railway company, the Peoria and Pekin (Ill.) Terminal Railway company, Sioux City (Ia.) City Traction company, Elgin (Ill.) City, Carpenterville and Aurora Railway company, Schenectady (N. Y.) Railway company, Detroit (Mich.) and Pontiac Street Railway company, Joliet (Ill.) Railway company.

The president then delivered his annual address.

President Sergeant's Address.

We are to-day assembled for the eighteenth annual gathering of our association, and for the second time we meet in this great and prosperous city.

I feel very deeply the honor which makes it my duty and pleasure to welcome you to Chicago in behalf of the street-railway men of this city, whose generous exertions have provided us with all the essential elements for a profitable and enjoyable meeting.

What remains to be done lies in your own hands, and I may be permitted to urge upon you the desirability of a full attendance upon the business meetings and a free and ample discussion of the papers which will be presented. In order that the time may be sufficient for this purpose, your executive committee has purposely restricted the papers to a smaller number than usual, and earnestly solicits your co-operation in giving them full audience and ample discussion.

As will be seen by the report which is to be submitted, the financial condition of your association is good and improving from year to year, for which happy condition we should not forget we are indebted to the efficient efforts of your officers in prior years, when the bank balance was not so readily visible; nor should the generous support of our exhibitions by our friends, the supply men, escape our notice.

The devotion of one day of your convention to the especial purpose of visiting the exhibits, which has been arranged by your executive committee, will be availed of, it is hoped, by every delegate, to the mutual profit of all.

Those gentlemen who met here in Chicago in 1883, many of whom are, I trust, present to-day, could have had little conception of the changes in their business which were to occur before the end of this century. At that time there were in Chicago street railways operating about 153 miles of single track. At the present time the mileage of the surface street railways of this city is about 736 miles, of the Chicago interurban street railways about 261 miles, and of the elevated street railroads about 100 miles, either operated or under construction, making an increase since your last meeting here of 944 miles of track.

This remarkable extension of street railways, their equipment with mechanical motive power, the unique Union Loop system and the successful application of electric power in the elevated-railway service, are not only a wonderful testimonial to the courage, energy and capacity of their projectors, but they have made Chicago a street-railway Mecca to which we all may come to observe and learn. We are, therefore, to be greatly congratulated upon the advantages afforded us by the selection of this city for our convention.

The year which has passed since we met has presented some unusual features which are worthy of our attention. The tendency toward consolidation of small or competing roads into larger homogeneous systems has been manifested by many examples. With the introduction of electric motive power the old-time horse-railway company, operating a few miles of track on two or three city streets, has disappeared, and its larger successor has found necessary such changes in administration, such extensions of its system and service, that the advantages of combination with rivals have become more and more manifest. The street railway which formerly gave a short-distance urban service has found itself extended far into the country; the same car which disputes the passage of a busy city street with a truculent teamster may an hour later be flushing partridges and grouse along the rural highway, stopping to leave the tired artisan at his country home, and bringing a healthful excursion within reach of the humblest family—thus the trolley car is rapidly filling a long-felt want which was neither within the power nor the disposition of the great steam roads to supply. All this means changed conditions, with new responsibilities, and emphasizes the need of consolidation.

To amalgamate such properties successfully and organize and operate them with due economy and a just regard for the needs of the communities to be served requires of the operating officials a high degree of experience and skill. The new problems to be met offer better positions, to which those who are ambitious may aspire, and the wonderful rapidity with which this situation has been developed will be a lasting monument to the officials of our American street railways. The advantages of this larger growth are many, and perhaps not the least is a growing respect for the value and importance of the street-railway industry, which we may all hope will, ere long, be recognized by just laws, which shall deal fairly and equitably with the relations of the street railways to the municipalities, and give to capital invested in urban and suburban transportation security and a fair return upon the investment.

AMERICAN STREET RAILWAY ASSOCIATION.—GROUP OF MEMBERS AND VISITORS AT LOCKPORT, ILL., ON DRAINAGE-CANAL EXCURSION.

Another of the notable events of the year has been the failure of a striking attempt at municipal ownership, with which we are all familiar.

It is greatly to be regretted that the year has been signalized by several very serious strikes and attempted boycotts. With the consolidation of systems the question of labor assumes a greater importance. The paralysis of all the transportation of a large city is a grave public calamity, to be prevented by all reasonable means in the power of the officers and men of the transportation companies, and by the municipal authorities. The larger the system of any corporation is, the more necessary it is that its management shall firmly and wisely conduct its affairs, and the more impossible that the responsibilities imposed upon the management should be delegated to others. Does it not, therefore, devolve upon us who are charged with such responsibilities to take the greatest care that our representatives before the public, the employes, shall always receive such liberal and just treatment at the hands of all our officials that they may feel their interests and ours to be identical, and may loyally work with us for the good service of the public and our corporations?

Care in the selection and instruction of employes may, therefore, well engage our constant attention. We are all merchants, in that we have transportation to sell, and must present it in an attractive manner, if we wish to retain our customers.

The good-will of the community which it serves

seems to be an essential element of success with any public transportation company, and the best means to obtain that good-will should receive our careful consideration.

In this direction lies, I believe, a field of work for our association and for each and every one of its members, which may be far more fruitful for good than our technical papers or our exhibits of apparatus.

We are all aware of the wide difference of opinion which exists in the community as to the proper relation of street railways to the public, the service they should render and the burdens they should bear, and, last, but not least, the returns which they should expect upon capital.

In the press and in educational and social-reform institutions, much prejudiced opinion and misinformation is promulgated calculated to injure public-service corporations, and in so injuring them, to deprive them of much of their ability to adequately serve the public. Is it not our duty, each and all, in our own communities and wherever else opportunity offers, to take steps to remedy this state of affairs?

Let us seize every opportunity to refute these current fallacies, meet the self-styled "economist" on his own ground and show him that his "quasi-public octopus" is the greatest public benefactor and social reformer the world has ever seen!

Fair-minded men will generally listen to both sides of any question, and the ignorance of even those who should be well informed as to our industry is so great that mission work to disseminate truth is imperatively demanded.

I believe that work of this character has already been undertaken by one of our friends of the Chicago technical press, and that in so doing he has set a worthy example, which we may beneficially follow.

One of the saddest events of the year was the sudden death, in April last, of our lamented friend, Mr. M. K. Bowen, president of the Chicago City Railway company. Beloved by all who knew him, ever ready to spare his valuable time for the aid and information of others who sought to learn from his experience, he was an honor not only to the corporation he served so well, but to the profession which will miss him so sadly. Ever faithfully interested in your association, his untimely death brings a feeling of deep loss to us all.

I venture to remind you of the work which our friends of the Accountants' association have undertaken and are accomplishing. The importance of accurate and uniform accounts to the success of any railroad can hardly be overestimated. A thorough knowledge of accounts and of finance are essential qualifications for the administration of large properties. The work so far accomplished by their association, and their further deliberations, merit your earnest support, which will not only be beneficial to them but to each and all of the members of our association.

I wish here to express my appreciation of the cordial support and valuable work of your efficient secretary and executive committee. That our association may always be so fortunate is my earnest wish.

In conclusion, may I once more express my sincere appreciation of the honor which you conferred upon me by electing me to preside over this meeting, and bespeak your patience with my shortcomings.

Reports of Committees and Officers.

Reports from the executive committee and from Mr. Penington, the secretary and treasurer, were received. The committee gave the results of its several meetings during the year, including the resolution that Friday, the last day of the convention, be set apart for a systematic and careful inspection of the exhibits. It was recommended that the special committee on the carrying of United States mail on street railways, of which Mr. John T. Burnett is chairman, be continued for another year. The various recommendations of the executive committee were approved by the association.

Secretary and Treasurer Penington reported that the receipts of the year were $11,307.15 and that the balance in the treasury on October 11, 1899, was $5,658.87. The number of company members is 172. The deaths during the year covered by the report were those of M. K. Bowen, president Chicago City Railway company, Chicago, Ill., April 9, 1899; William Penn Cooper, superintendent Thirteenth and Fifteenth street lines, Union Traction company, Philadelphia, Pa., February 23, 1899; John H. Callahan, secretary United Traction company, Pittsburg, Pa., February 13, 1899; DeWitt C. Cregier, ex-superintendent Chicago West Division Railway company, Chicago, Ill., November 9, 1898; William E. Hale, treasurer Toledo Traction company, Toledo, O., November 16, 1898; Joseph S. Lawrence, president Charleston Consolidated Railway, Gas and Electric company, Charleston, S. C., August 5, 1899; Charles F. Orthwein, vice-president Southern Electric Railroad company, St. Louis, Mo., December 28, 1898; Austin Ely Smith, treasurer and general manager Springfield Street Railway company, Springfield, Mass., August 8, 1899; Sylvanus M. Thomas, president and treasurer Taunton Street Railway company, Taunton, Mass., November 20, 1898; George Henry Wheeler, ex-president Chicago City Railway company, Chicago, Ill., August 11, 1899.

The report of the secretary was accepted.

Mr. Yerkes' Paper.

Mr. C. T. Yerkes' paper, "Investments in Street Railways: How Can They Be Made Secure and Remunerative?" was read by the author, and the reading and discussion took up all of the remainder of Tuesday's session. Mr. Yerkes was given a cordial reception and received the thanks of the association. The paper was discussed by Messrs. Wyman of New Orleans, Beggs of Milwaukee, Vreeland of New York, Foster of Lynn, Ifeft of Meriden, Conn., and others. (See pages 259-261.)

Reception at the Auditorium.

There was no set "feature" for Tuesday afternoon, but in the evening a pleasant reception to the visiting street-railway men and the ladies was given in the parlors of the Auditorium Hotel. There were flowers, music, light refreshments, the renewal of old acquaintances and the making of new ones. There was no stiff formality about the affair, but it was a pleasant social welcome and reunion.

Wednesday's Session.

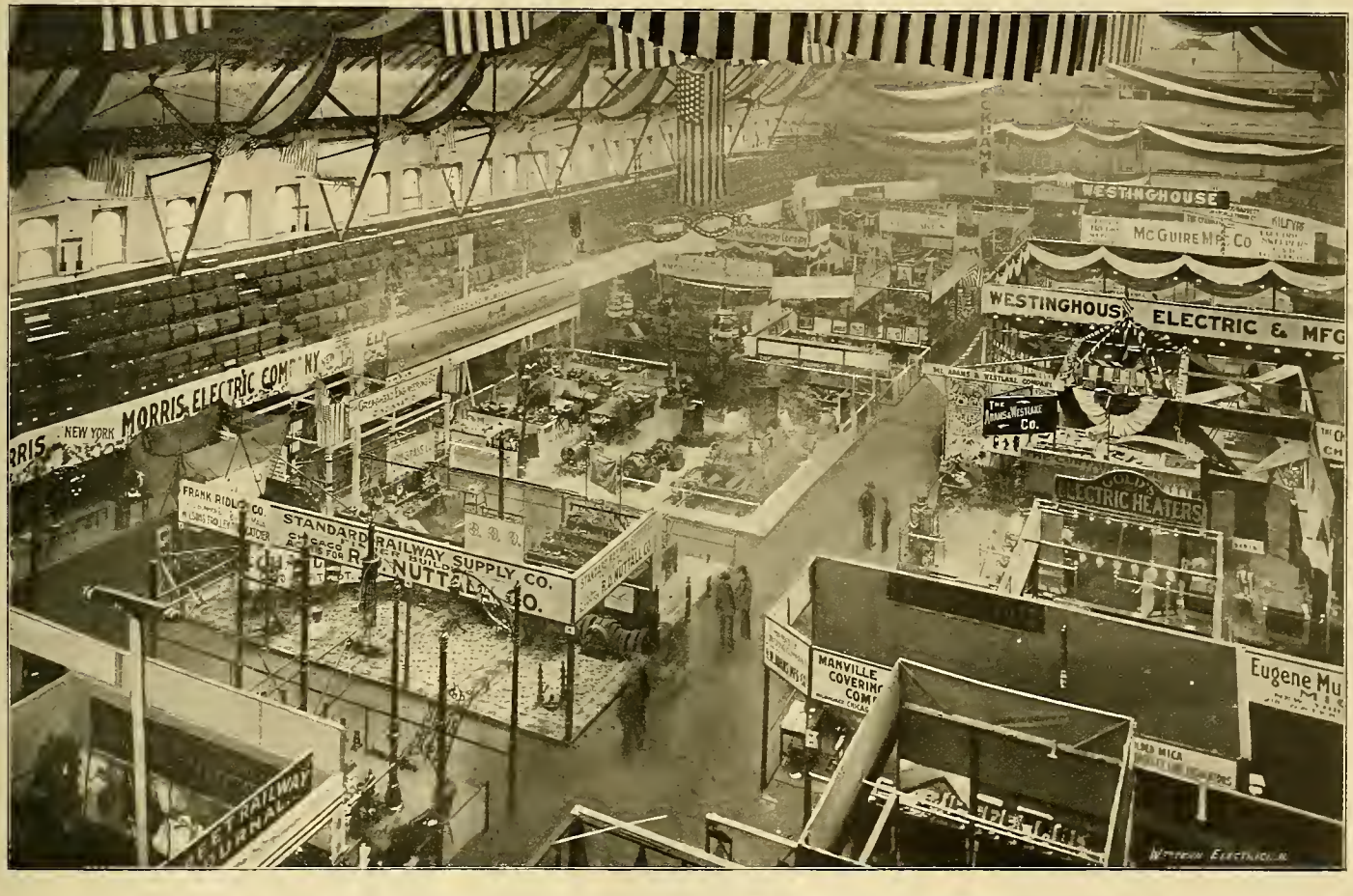
On Wednesday the association was called to order promptly, and the secretary read an invitation from the Siemens & Halske Electric company to visit its large manufacturing plant in Chicago. J. H. Vander Veer, superintendent of motive equipment of the Brooklyn Heights railroad, read a short paper, entitled "Maintenance of Car Equipment." This very practical subject was exhaustively discussed. The next feature was to have been a paper on "Modern Street-railway Shops," by B. L. Kilgour of the Cincinnati Street Railway company, but neither Mr. Kilgour nor his paper put in an appearance. It developed that the prospective writer was just about to be married, and in the agitation of that interesting event he had forgotten to notify the committee that he would be unable to present his paper. He was pardoned, under the circumstances; and it was suggested that Mr. G. W. Knox, the chief electrician of the Chicago City Railway company, who was to have led the discussion on Mr. Kilgour's paper, be asked to prepare a paper on the same subject for next year's meeting.

As the committee to nominate officers and select the next place of meeting the president appointed H. C. Moore, Trenton, N. J.; E. C. Foster, Lynn, Mass.; E. G. Connette, Nashville, Tenn.; Robert McCulloch, Chicago, Ill., and A. E. Lang of Toledo, Ohio.

Excursion Along the Drainage Canal.

Among the diversions provided for the entertainment of the members of the association and other visitors at the convention none was enjoyed more thoroughly than the excursion along the Drainage Canal on Wednesday afternoon. The party assembled at the Polk street depot about half-past one o'clock and found seats in a special train of 10 cars on the Santa Fe railroad. Nine of the cars accommodated the 500 ladies and gentlemen who made the trip and the tenth car was a baggage car that served as a receptacle for the refreshments served during the journey. The weather was delightful and the outing proved to be most pleasant in every respect.

Stops were made at various points along the line, and the excursionists obtained a good idea of the great work accomplished, both in earth excava-



AMERICAN STREET RAILWAY ASSOCIATION.—EXHIBITION AT TATTERSALL'S, CHICAGO.

tion and rock cutting. At Lockport, the southern terminus of the canal, the visitors inspected the massive dam and sluice gates by which the flow of water from the channel into the Desplaines River will be controlled. The object of the drainage channel is, of course, to provide a connection between the South Branch of the Chicago River, at Robey street, and the Desplaines River, near Joliet, so that a flow of water of at least 300,000 cubic feet a minute may be maintained from Lake Michigan through the Chicago River, the Drainage Canal and the Desplaines and Illinois rivers to the Mississippi River. Thus the sewage of the city will be diluted and diverted so that it will not contaminate the waters of Lake Michigan, from which the city water supply is obtained. Incidentally, it is suggested that power may be obtained by utilizing the head of water at Lockport or Joliet, and transmitted by electricity to Chicago.

The whole project, in its magnitude and methods of execution, excited the admiration of the visitors, who appeared to be unanimous in the opinion that the excursion had afforded not a little instruction as well as a pleasant outing. Scattered through the cars were many members of the local committees of arrangement, and they did much to make the occasion a profitable one by their explanations of points of particular interest.

At Lockport a number of the members of the excursion party were photographed in the group shown on page 248. J. W. Taylor was the photographer.

Proceedings on Thursday.

After several announcements, the first paper of Thursday was read by Mr. Edward Butts of the Metropolitan Street Railway company of Kansas City, his subject being "Construction and Maintenance of Street-railway Track" (page 262). Mr. Butts' paper caused a general discussion, and then President Sergeant called for the report of the nominating committee.

New Officers.

Mr. Moore presented a list of officers, which was adopted without opposition. It is as follows:

President—John M. Roach, general manager Chicago Union Traction company, Chicago, Ill.

First vice-president—John A. Rigg, president Union Traction company, Reading, Pa.

Second vice-president—H. H. Vreeland, president Metropolitan Street Railroad company, New York city.

Third vice-president—F. G. Jones, vice-president Memphis Street Railway company, Memphis, Tenn.

Secretary and Treasurer—T. C. Penington, treasurer Chicago City Railway company, Chicago, Ill.

Executive committee—The president, vice-presidents and C. S. Sergeant, second vice-president Boston Elevated Railroad company, Boston, Mass.; C. K. Durbin, general superintendent Denver Consolidated Tramway company, Denver, Colo.; Nicholas S. Hill, Jr., general manager Charleston Consolidated Street Railway and Electric company, Charleston, S. C.; Charles W. Wason, president Cleveland, Painesville and Eastern Railroad company, Cleveland, Ohio; John R. Graham, president Quincy and Boston Street Railway company, Quincy, Mass.

Next Convention at Kansas City.

In accordance with the report of the nominating committee, Kansas City was selected as the place of next year's meeting. Mr. Moore stated that invitations had been received from Cleveland, Kansas City and Charleston, S. C., also from Milwaukee for 1901 and from Toledo for 1902. Mr. W. H. Holmes, president of the Metropolitan Street Railway company of Kansas City, returned thanks for the selection, and promised to endeavor to make the association's visit a pleasant and profitable one.

Concluding Business.

Mr. Ira A. McCormack, managing director of the Syracuse (N. Y.) Rapid Transit Railway company, read the last paper presented. It was on "Train Service and Its Practical Application," and elicited a valuable discussion.

A resolution of thanks, adopted by the supply men in recognition of the action of the executive committee in specially setting aside Friday for the inspection of exhibits, was read by Secretary Penington. The supply men were especially grateful to Mr. McCormack for introducing the resolution in the committee.

The usual resolutions of thanks to those who had contributed to the success of the convention were adopted.

President Sergeant announced that there was no more business before the association, but that this year the officers would be installed at the banquet, so that adjournment would be taken to that time.

Before adjournment Mr. H. H. Vreeland of New York took occasion to say that this had been the first convention of the association he had attended since his connection with the street-railway business, and he had enjoyed the opportunity of extending his acquaintance and profited by the proceedings.

Thursday's Entertainments.

A tally-ho ride through the South Side parks and boulevards and a visit to Swift's packing-house in the stockyards were the features of Thursday afternoon. The processes in a great meat-handling establishment were a novelty to many of the visitors and they were inspected with great interest. Swift & Co. paid every attention to their visitors and gave heem as souvenir stick-pins with tiny gilded porkers, and also cakes of perfumed soap, packed in boxes bearing the name of the association and the date of the visit.

In the evening the local street-railway men entertained the delegates to the convention and their ladies, to the number of about 700, at a theater party at the Columbia Theater. The play presented was "His Excellency the Governor," and it was an especially arranged production in honor of the visitors.

GENERAL ELECTRIC COMPANY'S EXHIBIT AT CHICAGO STREET-RAILWAY CONVENTION.

The Closing Day.

Friday was especially devoted to the inspection of exhibits and to carriage rides and shopping tours for the ladies. In the afternoon, by the co-operation of the South Side Elevated Railroad company and the Westinghouse Electric and Manufacturing company, a number of the delegates inspected the "Alley L" power house at State and Fortieth streets. The working plant and the addition now making were thoroughly gone over.

The Banquet.

With the banquet of Friday night at the Auditorium the eighteenth convention of the American Street Railway association came to a close. About 300 ladies and gentlemen were present, and as a souvenir from the Christensen Engineering company of Milwaukee each lady received a beautiful basket of flowers. These tasteful gifts came as a surprise to nearly all present, and the generosity and enterprise of the donors were highly appreciated. The menu and table decorations were elaborate. A blessing on the dinner was asked by the Rev. J. A. Roudthaler, and at its conclusion several toasts were responded to under the happy direction of President Sergeant. The speakers were Senator W. E. Mason, J. W. Duncan and William J. Hynes of Chicago and J. Harry Stedman of Rochester, N. Y. Mr. Sergeant then surrendered his office to President Roach, who made a short speech expressing his thanks for the high honor and his appreciation of the efforts of the supply men and others to make the Chicago gathering an instructive and pleasant one. Mr. Roach referred in eulogistic terms to the administration of the retiring president, and at the conclusion of his remarks three cheers for Mr. Sergeant were given with a will. Remarks were made by Frank Jones of Memphis, vice-president, and Mr. Penington of Chicago, secretary, and then President Roach declared the meeting of the association adjourned.

Convention Gossip.

Frank B. Rae of Chicago found time to renew some old acquaintances at the exhibition.

Quite a number of steam-railroad men and very many street-railway men not members of the association were to be seen.

Charles A. Brown, the well-known patent attorney of Chicago, attended the convention and encountered many familiar faces.

C. D. Crandall, general manager of the Western Electric company, Chicago, was one of the prominent visitors to the convention.

The attendance of ladies was large and flattering. Probably 200 were present, and there is no reason to doubt that every one of them had a good time.

George F. Porter of New York, secretary of the National Electric Light association, and G. Tracy Rogers of Binghamton, president of the New York State Street Railway association, were visitors.

Exhibitors were indebted to James R. Chapman and George O. Nagle, respectively chairmen of the local committees on exhibits and halls and hotels, for many courtesies and prompt attention to their needs.

F. B. Badt, the Chicago electrical engineer, was seen at the exhibition chatting with old-time friends. Mr. Badt was much interested in the beautiful and delicate Weston instruments shown in the booth of Harold P. Brown.

Mr. Yerkes was the "star" of Tuesday's session. His paper was closely listened to and vigorously applauded. At the close of the session he received quite an ovation, members thronging to the platform to shake hands with him.

Luther Stieringer, the decorative-lighting expert, didn't miss the convention. He seldom misses anything in the way of an electrical show. He was on his way to Omaha, he said, and stopped in Chicago to greet his friends at the exhibition.

Both President Sergeant and Secretary Penington were gratified at the large and interested attendance of members at the daily sessions of the convention. They agreed that the Chicago meeting had very agreeably broken all records in that respect.

Col. C. B. Fairchild, the veteran street-railway writer, was a faithful attendant at every session of the association. Colonel Fairchild has lately made a new connection, and his cards now show that he is eastern manager of the Street Railway Review.

Edward Caldwell, now manager of the Trade Press Advertising agency of New York, was warmly greeted by many Chicago friends. For several years Mr. Caldwell was connected with technical journalism in New York and Chicago, but he left the field some time ago.

George A. Yuille, the secretary and "all-round handy man" of the Chicago committee of arrangements, was detained at home on the opening day of the convention by illness, but he managed to get out for the remaining days and to do much to further the enjoyment of the visitors.

Mr. T. E. Crossman of New York, the official stenographer of the association, did his part of the work of the week—and an important part it was—with the promptness and accuracy which have earned for him the good wishes of the secretary and the technical journals in former years. Mrs. Crossman accompanied her husband.

About 40 men appeared for the technical press at the convention. Among the journals represented were the Tramway and Railway World of London, Street Railway Journal, Street Railway Review, Railroad Gazette, Railway Age, Modern Machinery, Electrical Review, American Electrician, Electrical World and Engineer, and Western Electrician.

A. M. Willcox, the representative of the Tramway and Railway World of London, was doubly busy in looking after the interests of his journal and in utilizing such an excellent opportunity to talk up the tramway exhibition to be held in London next summer under the auspices of the Tramway World. Mr. Willcox is an American by birth, and many old friends in electrical and street-railway circles availed themselves of the opportunity of meeting him.

For the second time the branch Appellate Court, through the medium of Judge Horton, has denied the right of the General Electric Railway company of Chicago to lay its tracks along Custom House place, between Fourteenth and Polk streets. For some time the laying of the rails has been contemplated under a special ordinance passed by the City Council. Matters came to a focus on October 30, 1898, when an attempt to lay the tracks was blocked by the Chicago and Western Indiana Railroad company, which secured a temporary injunction from Judge Payne. The Appellate Court sustained the injunction, and a final order was entered in February, 1899. The present appeal was from the final order.

THE EXHIBITION.

Large and Varied Display of Apparatus at Street-railway Convention.

Next in importance to the gathering of the association itself was the exhibition at Tattersall's, by manufacturers and dealers from all over the country, of nearly everything needed for the construction, equipment and operation of the modern electric railway. The whole main floor of the hall was filled with exhibition booths, the aggregate amount of space devoted exclusively to the exhibitors being over 12,000 square feet, while a few exhibits were placed in the gallery and on the curb in Dearborn street, west of the building. Among the exhibits were displays of car motors and trucks, fenders and gates, fare registers, seat and curtain furnishings, headlights and lamps, generators and switchboards, telephones, line and track material; in fact, about everything needed for the equipment of street cars and power houses. The largest exhibits were those of the General Electric company and the Westinghouse Electric and Manufacturing company. They occupied prominent positions in the center of the hall. Considering the short time for which the goods were displayed, the exhibition was certainly a very good one, and it was not alone instructive to the delegates and supply men in attendance, as a large number of spectators visited the hall and were well repaid. From the local street-railway companies, too, delegations of employes marched to the hall and inspected the exhibits, to their instruction and profit.

Westinghouse Electric and Manufacturing Company.—One of the largest, most attractive and interesting exhibits was that of the Westinghouse Electric and Manufacturing company. Occupying a very prominent position, in the center of the hall, the booth was made more conspicuous by means of a large electrical sign suspended above the exhibit and bearing the word "Westinghouse." The exhibit was of a specially interesting nature, from the street-railway man's point of view. One of the most striking features of the display was a 10-pole, 500-kilowatt, engine-type railway generator, the field and armature of which were mounted separately. This generator is one of three of equal size which the company has recently sold to the Monongahela Traction company of Pittsburg. On the opposite side of the booth was erected a complete railway switchboard of the Westinghouse standard type. It consisted of three generator panels, six feeder panels and one load panel, and is to be erected with the generator in the power house of the Monongahela Traction company. A 200-kilowatt rotary converter, with starting motor, occupied one corner of the exhibit. The remainder of the display consisted of two No. 68 500-volt railway motors mounted in operating order on a Peckham truck, two No. 49 500-volt railway motors mounted in operating order on a McGuire truck, four 10-series multiple controllers, a No. 70 and a No. 69 railway motor complete, three complete railway armatures, and a No. 69 armature, partially wound, with commutator partially connected. There was also a complete line of detail apparatus, including fuse boxes, lightning arresters, canopy switches, etc., used in street-railway equipment. The Nos. 68 and 69 motors mentioned are the latest type of railway motors built by the Westinghouse company. In placing these motors on exhibition, the company desired to bring before the public its newest achievement in electrical design. An important feature of the new motor is the increased current-carrying capacity of the field windings, which allows of an equal temperature rise in both field and armature. Heretofore, cases have often been noted where the armature was in good condition, while the field coils were roasted and ruined, due simply to the fact that the design of the motor was such that the temperature of the field coils rose to a far higher degree than that of the armature. Another feature is in the use of field poles, which are bolted to the yoke instead of being cast in, as has been the practice for the past 10 years. The success which these new motors have met with since being placed upon the market has far exceeded the company's greatest expectations. They were built originally on an order from the Third Avenue Railway company of New York city. A large order has also been received from the Brooklyn Rapid Transit company. The exhibit was in charge of William Bauder of Pittsburg, who was ably assisted by the following-named gentlemen: J. M. Duncan, C. S. Cook, F. McCoy, J. H. Reid, C. E. Skinner, N. W. Storer, F. S. Smith, W. M. Probasco, Pittsburg, Pa.; W. W. Grant, Ottawa, Ont.; J. R. Gordon and E. Woodruff, Atlanta, Ga.; H. C. Marsh, Cincinnati, O.; R. S. Brown, Boston, Mass.; C. H. Bragg, Philadelphia, Pa.; A. Hatet, Paris, France; C. S. Powell, Cleveland, O.; T. Julian McGill, Minneapolis, Minn.; C. F. Medbury, Detroit, Mich., and Arthur Hartwell, W. S. Rugg, Irvin Dryer, C. W. Regester, Frederick Nelson, C. G. Burton, W. R. Pinckard, L. M. Harvey, T. A. Hall, T. P. Gaylord and Ivor Hennings from the Chicago office.

General Electric Company.—The General Electric company's exhibit occupied a large central booth, covering 1,600 square feet. It comprised street-railway motors and controllers, switchboards, lamps, instruments, line material, etc. There were two "G E 55" motors of 150 horse power capacity each, mounted on a truck, the whole of which is to be used as part of the equipment of the Northwestern elevated railroad, now building in Chicago. On another truck of the St. Louis Car company make were mounted two "G E 100" motors, equipped with a "B 13" controller and electric brakes. These motors were in operation during the week and they attracted considerable attention. One of the special features of the exhibit was the showing of one of the company's new "G E 65" motors of 250 horse power capacity which are being built expressly for the Paris and Orleans Railway, Paris, France. Other street-car motors were shown, as well as a new "G E" type stationary motor. An air compressor for elevator work, one of a new line which the General Electric company is manufacturing, was on view. The switchboard exhibited included a latest-type feeder panel, two generator panels and an additional panel upon which was mounted a station wattmeter. All of the panels were of the General Electric standard street-railway type. A large line of supplies of overhead material was displayed, also circuit-breakers, lightning arresters, assembled commutators, armature coils and porcelain insulators, similar to those used on the third-rail electric system. Arc lamps were hung at the corners of the booth and also illuminated a painting at the rear that extended along one whole side of the exhibit. The painting was made to represent the Chicago and Milwaukee electric railway and the territory through which it passes. This railway, of which a detailed description was given in the Western Electrician under date of October 21st, was designed by Bion J. Arnold and constructed by the Arnold Electric Power Station company of Chicago, while all the generators, rotary converters, transformers, switchboards and other electrical equipment were furnished by the General Electric company. A large delegation from the various offices and factories of the company were on hand to represent the General Electric company's business, among whom may be mentioned the following-named: S. D. Greene, W. F. Hayes, W. B. Potter, Ward S. Arnold, S. Trawick, B. E. Sunny, F. N. Boyer, George Rosenthal, F. Barbour, J. G. Barry, E. D. Mullin, W. J. Ferris, J. W. Buell, T. P. Bailey, E. D. Priest, J. H. Livsey, R. D. Beach, J. J. Mahoney, H. R. Bishop, Jr., F. W. Wilcox, F. M. Kimball, George Breed, F. E. Case, R. A. Swain, R. S. Moore, F. H. Strieby, George J. Cadwell, W. C. Carey, A. H. Armstrong, J. W. Johnson, T. Ferris.

American Steel and Wire Company.—The exhibit of electric wires and rail bonds made by the American Steel and Wire company was one of the most attractive in the hall. Suspended from the ceiling, over the booth, was a large figure-8 rail bond. It was illuminated with numerous incandescent lights, the openings in the 8 containing the words "Crown Bonds," made up of a large number of electric lights; and it could be seen from almost any portion of the hall. In an ornamental glass case were shown solid and flexible Crown bonds in almost every conceivable shape and size. The case was surrounded by tables on which other Crown bonds were piled in heaps, and which the public was permitted to handle as much as it pleased. Crown bonds for bonding under the fish plates, over the fish plates and under the rails were displayed in a manner that could not help but win attention, while Mr. E. J. Pietzcker, or one of his amiable assistants, was always on hand to explain how Crown bonds could be easily adjusted to the rails at such a saving of labor as would compensate the purchaser for the full price of the bond over other makes. Besides the rail bonds there were two huge pyramids of trolley wires, feeder cables and other forms of insulated wires—the product of the celebrated Washburn & Moen department—and another large and attractive glass case contained a varied assortment of large-sized cables—armored, insulated and lead-encased—for all of which product the Washburn & Moen department of the American Steel and Wire company has become famous. Still another part of the exhibit was a pile of double-galvanized telegraph and telephone wire, which, under the title of W. & M. high-grade, has become a standard wire for telephone and telegraph use. These wires are made in accordance with the Western Union and Postal Telegraph company's most strict specifications, and are said to be far superior to ordinary iron and steel wires. The three grades—Extra B. B., B. B. and Steel—were all shown, with a clear exposition of their comparative conductivity and tensile strength. The woven-wire-fence department of the company made a very attractive display of American and Ellwood styles of woven-wire fence, while a panel of the American fence was shown erected, with stretcher attached, illustrating the method of putting it up.

Harold P. Brown and Badt-Goltz Engineering Company.—An especially instructive and interesting exhibit was shown by Harold P. Brown, who has made the Plastic rail bond famous. Mr. Brown had a testing apparatus in operation, by means of which he made tests of the conductivity of his Plastic and solid-copper bonds. A 20 horse power Edison motor drove an electroplating machine of 10 volts and 3,000 amperes' capacity. In series with the terminals of this machine were connected two rail-joint sections. One of these sections was of the 80-pound T-rail, such as used on the Metropolitan elevated railroad, and the other was a 70-pound section from the North Chicago street railroad. The 80-pound rail was not bonded, while the smaller rail was. A Weston shunt was placed in series with the two joints, the ends leading to a Weston ammeter. The voltage of the joints was taken by means of a very delicate voltmeter. Mr. Brown kindly conducted a test for the representative of the Western Electrician, the results of which follow. With the 80-pound rail a 2,000-ampere current registered a difference of potential of .425 volt across the joint, .01942 volt with a bond laid across the joint and .00221 volt for a space of one inch of the rail. The 70-pound bonded rail registered .02124 volt across the joint, .00842 volt with an extra bond laid on top of the joint and .00284 volt through one inch of the rail. The test showed that the drop of potential across the joint of the bonded rail was about eight times that of the solid rail, while an unbonded rail showed a corresponding drop of over 200 times. The voltmeter used by Mr. Brown was constructed especially for him by the Weston Electrical Instrument company and is said to be the most sensitive instrument of its kind ever constructed. It has three scales and will read to the .000001 part of a volt. Its highest reading is 7.5 volts. Mr. Brown was assisted in his exhibit by the Badt-Goltz Engineering company of Chicago, western representative of the Weston company as well as of Mr. Brown.

Falk Company.—Herman W. Falk and Clement C. Smith, president and vice-president, represented

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY'S EXHIBIT AT CHICAGO STREET-RAILWAY CONVENTION.

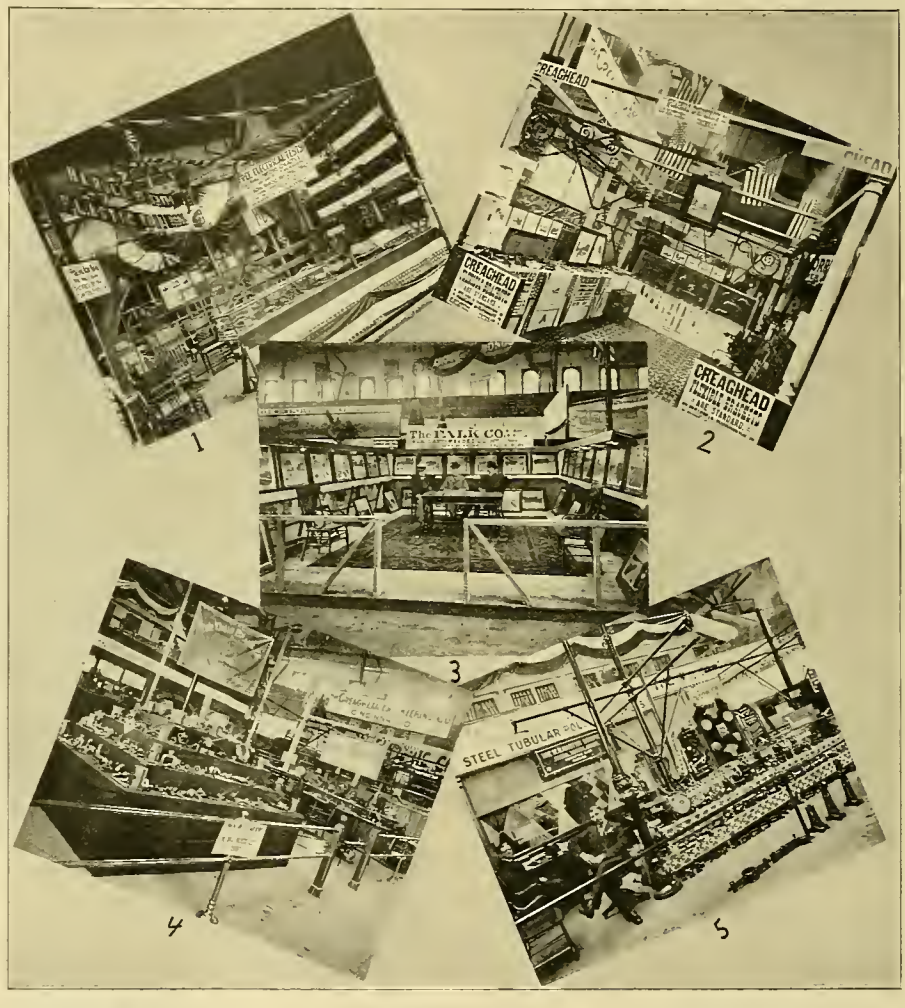
the Falk company of Milwaukee. They were assisted by Secretary and Treasurer E. A. Wurster, Assistant Secretary C. L. Jones, General O. H. Falk, and J. A. Wendell and R. L. McDuffy, the eastern agents. This year the company made an exhibit somewhat out of the ordinary. Instead of displaying materials and samples, the company had on exhibition a large number of handsomely framed photographs of the work done by the firm. The photographs principally illustrated street-railway construction, a branch of work in which the Falk company has extensively engaged this year. The company is building 16 miles of track for the Metropolitan Street Railway company of Kansas City, and several of the photographs showed different stages of construction work on the Metropolitan lines. What is known as the "trench" construction is being employed there; the tracks are laid in concrete in the asphalted streets, without any ties, and joints of the rails are cast-welded by the Falk process. Other pictures gave views of the line and the power house of the Oshkosh (Wis.) and Neenah interurban electric railway, the complete road being built by the Falk company. A piece of welding, under disadvantageous conditions, on the Third Avenue railroad of New York city was well illustrated in one view. Cars were operated on the line all night, in this case, and a special clamp had to be provided, that held the rails in position and did not interrupt the cars. The remainder of the photographs illustrated the firm's gears and pinions and special work, such as switches, frogs and crossings.

Garton-Daniels Electric Company.—One of the most interesting exhibits at the convention was that of the Garton-Daniels Electric company of Keokuk, Ia. This exhibit was thronged with visitors most of the time who were attracted by the company's excellent display or by the engaging personal qualities of Secretary J. V. E. Titus. Mr. Titus was always on the alert to explain to his callers the merits of a full line of arresters. The company exhibited a panel of lightning arresters connected to a 500-volt circuit and operated by a static machine. The exhibit also comprised a full line of pole, car and station arresters and samples of 500 and 800-ampere kicking coils. A special feature of the exhibit was the Knox "automotoneer." This, as may not be generally known, is a device for street cars which is designed to prevent too rapid starting of electric cars, and is said to save power and cost of repairs, to lengthen the life of motors and to enable street-railway owners to double the number of cars with their present station equipment. Many other claims are made for the automotoneer, and the Garton-Daniels company, which will control the manufacture of this device, will be pleased to send further particulars on request. Mr. Titus made many friends at the convention, and incidentally took a number of orders for the company's products. This is not a matter of surprise, as his close attention to business and his courtesy to all deserve success.

Standard Paint Company and **Western Electric Company.**—One of the most attractive booths in the hall was that of the Standard Paint company of New York city. The booth was resplendent in flags and bunting and showed the exhibits to advantage. Mr. Frank S. DeRonde, the general manager of the company, was ably assisted by J. C. Shainwald, western manager, and Mr. F. S. Howard, traveling representative, entertaining delegates and friends. The free distribution of one of the most attractive souvenirs given at the convention caused the aisle of the Paint company's exhibit to be blocked at all hours of the day. The Western Electric company was represented at the convention by J. C. Cannon, Philip Rust and F. L. Swan. It had headquarters with the Standard Paint company, where it entertained friends of the company and distributed printed matter and souvenirs to the visitors. Mr. A. L. Tucker of the Western Electric company, a member of the committee on publicity for the street-railway convention, was, of course, in attendance. The souvenir distributed by the Western Electric company was a match-box, having on one side an illustration of a Petite arc lamp, on the other an illustration of a 16-inch fan motor, and on both edges of the box "Western Electric Company, Chicago-New York." The box is finished in silver and white celluloid. A handsome leather card-case was also given out.

Eugene Munsell & Co. and **Mica Insulator Company.**—The combined exhibit of Eugene Munsell & Co. and the Mica Insulator company of New York, Chicago and London, occupied 200 square feet. The booth was tastefully designed, dark, rich, blue material being used as the background, paneled in gilt, which gave a rich effect. The Mica Insulator company's exhibit consisted of micanite plate, flexible plate, cloth, paper, M. I. C. compound, Empire cloth and paper, micanite tubes and troughs, and various forms of insulation, of which this company makes a specialty. Eugene Munsell & Co.'s exhibit consisted of mica in the sheet and a variety of sizes. Both the India and amber qualities were shown, also mica as it comes from the mines and mica segments. Directly over the desk, suspended from the sign, was a large rare specimen of India mica, in size 14 inches by 36 inches, probably one of the largest sheets ever mined. This is such a rare specimen that there are probably less than three or four pounds of mica of these dimensions in the United States. The souvenir distributed was a neat card-case, and it was highly appreciated by the delegates in attendance. The exhibit was in charge of Charles E. Coleman, western manager, assisted by Howard M. Frantz.

Garl Electric Company and **Cling-surface Manufacturing Company.**—One of the most interesting and attractive exhibits at the convention was that of the Garl Electric company of Akron, O. Mr Garl personally looked after the exhibit, and visitors were well entertained by him. The Garl company exhibited its portable street-car telephone and pocket telephone, besides many other kinds of telephones. The automatic burglar and fire alarm shown by the Garl company attracted hundreds of visitors to the Garl exhibit. Mr. Garl took many orders for his burglar alarm and telephones. The Cling-surface Manufacturing company of Buffalo, manufacturer of the well-known Cling-surface belt preservative, made a display near the Garl company. The exhibit was in charge of the Chicago manager, F. C. Willis, and of W. H. Lyman, who showed samples of Cling-surface and distributed testimonials and other literature to show the popularity of their product. Many trial orders were taken by Mr. Willis. It was a matter of regret that Manager A. B. Young could not attend the convention.



1. Harold P. Brown. Badt-Goltz Engineering Co.
2. Creaghead Engineering Co.
3. Falk Co
4. Ohio Brass Co.
5. Electric Railway Equipment Co. W. R. Garton Co.

EXHIBITS AT THE CHICAGO STREET-RAILWAY CONVENTION.

K. McLennan & Co.—One of the most earnest workers at the exhibition was M. J. Isaacs, general manager of K. McLennan & Co., manufacturers of the well-known Gale commutator compound. Mr. Isaacs made a very good exhibit and gave away several thousand samples of his compound. A striking feature of the exhibit was a large bulletin of testimonials from all over the world from users of Gale's compound. This was a unique feature and attracted considerable attention. During one of the committee meetings of officials of the association it was announced that the McLennan company was distributing what was considered one of the best souvenirs at the convention. This announcement brought many delegates to the McLennan exhibit. In looking after the interests of his customers Mr. Isaacs was ably assisted by J. B. Castle and J. F. Wells.

Ohio Brass Company.—A pyramid displayed the products of the Ohio Brass company of Mansfield, O. The firm was well represented by the secretary, C. K. King, A. L. Wilkinson, from the Ohio territory, R. A. Byrns of the New York office and George A. Mead, engineer of the company. These were assisted by J. H. McGill of the Chicago office and Mr. Scudder from the St. Louis branch. Mrs. C. K. King assisted in distributing souvenirs, which were very popular and consisted of small side-bearing feed-wire insulators, filled with Dirigo insulation, and supplied with a bit of ribbon, so that it could be fastened in a button-hole. The exhibit consisted of a full line of flexible pole brackets, genuine bell-metal bearings, linemen's tools, adjustable track brush holders and brush brooms, knife switches, and, as a special feature, Monarch track scrapers.

Eureka Electric Company.—A very complete telephone exhibit was shown by the Eureka Electric company of Chicago. It consisted of a line of high-grade Eureka apparatus, including new branch auxiliary combination telephone switchboards, which are said to be especially adapted for street-railway work, and instruments adapted to be used with the company's new central-energy system. The company is now equipping, at Houston, Tex., what is said to be the largest Independent exchange installed this year. New 1900 catalogues were distributed for the company, which was represented by J. J. Kusel, president, and H. J. Kusel, vice-president, during the day, and G. Rowe, treasurer, and C. Burlingham, superintendent, during the evening. Arthur Stein, secretary for the company, did the honors with the ladies.

Creaghead Engineering Company.—The Creaghead Engineering company of Cincinnati, O., made its usual large exhibit of flexible brackets, line material, pole fittings for wood and iron poles, etc. A special feature was shown in an extra heavy flexible bracket, designed and furnished for the reconstruction of the overhead work on the New Orleans and Carrollton railway at New Orelans, which is said to be one of the finest pieces of overhead work in the world. The company's new type of hangers for "figure-8" and other grooved wires attracted much attention. A collection of large photographs showing the company's material in use on roads in different parts of the world completed this interesting exhibit, which was in charge of the firm's superintendent, G. R. Scrugham. The company's souvenir was a neat steel pocket rule.

Central Union Brass Company and **Central Electric Company.**—An attractive exhibit of line materials, car trimmings, trolley arms, etc., was displayed by the Central Electric company, which acts as the Chicago selling agent of the Central Union Brass company of St. Louis. An old-time method of transportation was represented by a

brass model of a team of oxen hitched to a stone boat, while the modern method was shown in a model of an up-to-date trolley car. T. C. White of the Central Union company and M. M. Wood, manager of the railway department for the Central Electric company, were in charge of the exhibit. They distributed to their friends useful souvenirs in the shape of brass paper-knives.

Tramway and Railway World.—The Tramway and Railway World of London had one of the best spaces in the hall, where Mr. A. M. Willcox entertained many visitors and delegates. Special interest was shown in the International Tramways and Light Railways Exhibtion, which will be held in London next year. This exhibition is being arranged by the proprietors of the Tramway and Railway World, and Mr. Willcox had much to say about it.

Electric Railway Equipment Company and W. R. Garton Company.—A general line of overhead material, iron and steel poles and bracket arms manufactured by the Electric Railway Equipment company of Cincinnati was shown in an attractive manner in its booth. William A. McCallum was in charge of the exhibit, assisted by Mr. P. F. Harten. In conjunction with this exhibit the W. R. Garton company of Chicago had an attractive display showing products of the many concerns it represents, such as the Keystone Electrical Instrument company, Miller-Knoblock company, Massachusetts Chemical company and A. O. Schoonmaker.

Dearborn Drug and Chemical Works.—R. F. Carr, general manager of the Dearborn Drug and Chemical Works of Chicago, was assisted by C. J. McMaster, the mechanical engineer of the company, in entertaining delegates and visitors who were interested in the company's attractive exhibit. Sample pipes and tubes taken from boilers in various parts of the country were displayed, showing an accumulation of scale from the use of impure water. With the use of the chemical preparations prepared by this company the life of boilers and feed pipes is prolonged for many years. The attractive souvenirs distributed were much sought after.

Notes of Exhibits and Exhibitors.

John T. McRoy, the New York "conduit man," was in attendance.

L. E. Meyers, the electrical contractor of Chicago, was at the exhibition.

The Street Railway Review issued a daily during the convention, and it was widely distributed.

E. L. Barr of the Waclark Wire company of Chicago made many friends at the convention.

The Simplex Electrical company was represented by its well-known western manager, H. R. Hixson of Chicago.

Charles E. Brown, secretary of the Central Electric company, Chicago, was on hand to meet his many friends.

E. L. Clark, secretary of the Valentine-Clark company of Chicago, represented his company in his usual able manner.

It was regretted that J. Auerbach, treasurer of the Sterling Arc Lamp company of New York, could not attend the meeting, although the company's interests were well taken care of by its western agents, Gates & Randolph.

The American Vitrified Conduit company of New York was ably represented at the convention and exhibited several styles of conduits.

The "New Lynn" incandescent lamp, which is especially adapted for street cars, was considerably talked about at the convention.

James Wolff, Chicago, representing the New York Insulated Wire company, was seen at the convention, where he entertained many friends.

Charles Holmes, purchasing agent of the Chicago Edison company, found time to mingle with his many friends at the convention.

C. A. Benton of the Chicago office of the Sprague Electric company received a warm welcome from his many friends who attended the meeting.

Naugle, Holcomb & Co. of Chicago, the well-known dealers in street-railway poles and supplies, were not in the list of exhibitors, but inquiries were made for their work and apparatus.

Among those who were missed at the convention may be mentioned Alfred A. Thresher, president of the Thresher Electric company of Dayton, Ohio.

George H. Smith, manager of the Re-new Lamp company of Boston, Mass., spent considerable time at the convention in the interests of his company.

The Pittsburg Reduction company of Pittsburg exhibited aluminum cables and wire, now coming into use, to some extent, for electrical purposes.

Among the distinguished visitors from the East who attended the meeting was S. Dana Greene, general sales manager of the General Electric company.

F. E. Donohoe and E. H. Hammond of the Chicago office of the American Electrical Works represented American wires and cables at the convention.

Watson & Stillman, New York, manufacturers of hydraulic tools, showed a motor lift, rail punches and a girder bender, which were inspected with interest.

Frederick T. Hubbell, special representative of the Monarch Fire Appliance company of New York, exhibited the company's well-known Kilfyre extinguisher.

James A. Lounsbury, now representing Greenlee Bros. of Chicago, and a well-known electrical man of former days, renewed acquaintances at the convention.

Of course, no convention would be complete without the popular W. W. Low, president of the Electric Appliance company, Chicago, who was "right in it."

W. N. Matthews of St. Louis was not able to attend the meeting, but his friends inquired for him and regretted that he was obliged to be among the absentees.

The Eagle Electric Works of Peoria would undoubtedly have found it profitable to be at the convention, but the company did not find time to send a representative.

Where was Colonel S. G. Booker of the Phœnix Battery Manufacturing company of St. Louis? It was too bad that the genial colonel could not attend the convention.

President J. C. Knoblock of the Miller-Knoblock company of South Bend, and A. W. Morrell, manager of the electrical department, did the honors for this well-known company.

Frederick Sargent and A. D. Lundy, the well-known electrical engineers of Chicago were, of course, at the convention, renewing acquaintances with friends from all over the country.

Seymour Swarts, president of the Swarts Metal Refining company, Chicago, was, of course, on hand to renew acquaintances. Mr. Swarts made many new friends at the convention.

Many inquiries were made for F. S. Hunting, sales manager of the Fort Wayne Electric Works, who was unable to be present, however, owing to the demand for Fort Wayne products.

The Jackson & Sharp company of Wilmington, Del., builder of car trucks for cable, electric, suburban and interurban, elevated and steam service, was represented by J. Monteith Jackson.

The Rolfe Electric company of Chicago, manufacturer of protective devices, did not have an exhibit at the convention, but was ably represented in the person of President Charles A. Rolfe.

Edgar S. Nethercut, chief engineer of the Paige Iron Works, Chicago, was in charge of the company's exhibit at the convention. Some of the Paige special-track work was shown and attracted considerable attention.

The Crane company exhibited extra heavy gate, globe and angle valves, pipe dies, and back-pressure and blow-off valves for 100 and 50-pound pressures. J. A. Minwegan of the engineering department represented the firm.

The Electrical Installation company of Chicago had no exhibit, but as its business is with street-railway companies to a large extent, Manager Brett and other officers of the company were on hand to meet their friends.

A very complete line of street-railway supplies was exhibited in the booth of McGill, Pomeroy & Co. Mr. J. H. McGill, J. W. Porter and E. R. Mason were in attendance at the exhibit and entertained their friends.

The Shelby Steel Tube company of Cleveland, O., showed several of its "Shelby Three" trolley poles in the exhibit of the Cutter company. The special features of this pole were remarked upon by a large number of delegates.

The Consolidated Car Heating company of Albany, N. Y., made an interesting exhibit, which was in charge of W. P. Cosper, its St. Louis agent, R. P. Scales, the Chicago agent, and J. N. DuBarry, Jr., the New York agent.

[*Continued on page 257.*]

1. Dearborn Drug and Chemical Works.
2. { Garl Electric Co. / Cling-surface Manufacturing Co.
3. { Central Union Brass Co. / Central Electric Co.
4. American Steel and Wire Co.
5. K. McLennan & Co.
6. Tramway and Railway World.
7. { Eugene Munsell & Co. / Mica Insulator Co.
8. Garton-Daniels Electric Co.
9. Eureka Electric Co.
10. { Standard Paint Co. / Western Electric Co.

EXHIBITS AT CHICAGO STREET-RAILWAY CONVENTION.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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A corespondent, noting the recent statement of the Western Electrician that three new electric fountains at the Crystal Palace in London had attracted enough attention to give the idea that the spectacle was a novelty in England, directs attention to the fact that there was a pretty good electric fountain at Crystal Palace as far back as 1887. It must be, then, that the new fountains, which were designed and installed by an American, with American machinery, are so much in advance of the old one that the Londoners have a practically new delight.

Chicago is honored as the home of both the president and the secretary of the American Street Railway association. In the history of the association no city has enjoyed a similar distinction before. Mr. Roach is an energetic, capable and active man and will no doubt give the society a progressive administration, while Mr. Penington may be relied upon to continue to discharge the duties of secretary and treasurer to the satisfaction of all concerned. The association is undertaking another innovation in going as far west as Kansas City next year, and the street-railway and supply men throughout the West must see to it that the compliment is appreciated by a large attendance. With its record of 2,000, Chicago has set a mark that it will be difficult to exceed, but there is no doubt that Kansas City will entertain a big and enthusiastic convention.

A very largely attended and business-like convention was that of the street-railway men last week. The exhibition of machinery and apparatus was of large extent and possessed real value and interest. The association had ample time to transact its business, to hear and discuss the papers presented and to inspect the exhibits. The same observation is true of the Accountants' association, which held its annual meeting in conjunction with that of the older and larger organization. Several social gatherings and excursions added to the success of the affair. The only drawback was that the hall of meeting and place of exhibits left something to be desired in arrangement and location. But this was inevitable, as the only available building in town suitable for a large exhibition hall had been secured. By another year, if Chicago manages to evade the persistent ill-luck that seems to follow its large exhibition buildings, the city will have something better to offer.

It is curious that the poor roads in the United States should have proved to be, for the time, a benefit to some of the automobile makers of the country. The condition of the highways has practically restricted the use of light self-propelled vehicles to city streets, and in consequence some manufacturers have looked abroad for a ready and easily developed market. They have been successful, for the Americans have produced lighter and more graceful machines than their British or continental competitors, without the sacrifice of strength or reliability. As a consequence an export trade of considerable extent has sprung up in the United States. In a neighboring state there is an automobile factory that is steadily sending its entire output to Paris, and which will be, it is said, engaged on foreign orders for months to come. Other concerns are sending a considerable portion of their output abroad. If it had not been for the bad roads in this country, it is probable that this new branch of American export trade would have been neglected, for the domestic manufacturers would have had no incentive to look abroad for business.

Some medical writers profess to see a similarity between space telegraphy and "thought transference." One of them argues in this fashion: "Marconi has shown that a small electric battery can send waves of energy and intelligence through the ethereal atoms of space for a greater or less distance, according to the elevation, which may be caught up by a sensitive mechanical receiver and its code of signals recorded and interrupted. In the battery a small amount of material is decomposed to produce the electric current. The brain is, to a certain extent, a battery, and the ganglions of the great sympathetic nerve relay batteries to insure a continuous supply of the nervous energy generated in a great measure by the brain. This battery, with its relays, by the nourishment supplied to the body, decomposing its own material thus supplied, is perpetually in action. Thought is to a certain extent the outcome of cerebral action, the same as electricity is a force evolved from the decomposition of elementary substances. Thought, then, is an entity, a force, something which can travel through space and be caught up by a receiver, however distant, which is in tune with its vibrations." The speculation is an ingenious one. However, it is hardly likely that electricity, with all its interesting and valuable properties, will prove to be the agent to bridge the chasm between mind and matter.

One of the subjects very naturally discussed at the International Commercial Congress in Philadelphia was need of cable communication between the countries and islands of the Pacific Ocean. For over 30 years various projects have been discussed. General A. S. Hartwell, delegate from the Hawaiian Islands at the meeting in Philadelphia, outlined the situation. In part he said: "The volume of our commerce with the Orient and Australasia is already large, and permits no delay in the establishment of a complete system of Pacific Ocean cables. The governments concerned will either have to establish such cable lines at their own expense or aid private companies, whose lines will be under governmental control. The powers interested are the United States, England, Germany, France, Russia, China and Japan. A complete system of cables would require lines from the Pacific coast to Hawaii, thence to Yokohama, by way of Manila; from Yokohama to Vladivostock, there connecting with the Trans-Siberian telegraph; and for the South Pacific Ocean, from Hawaii to Sydney by way of Samoa and Fiji, as well as for the French interests by way of Tahiti and the French island of Neumea to Sydney. It is understood that the French government desires to connect its South Pacific islands with the Pacific coast by way of Hawaii, and also that the British government desires to establish lines from Sydney to Hawaii China and Japan would doubtless both unite with the United States in establishing or aiding cable communication between their respective countries and the United States by way of Hawaii." It is evident that the lack of communication across the Pacific—an anomaly at the close of the nineteenth century—cannot be suffered to exist much longer. The interests of the United States demand that one, at least, of the cables to be laid should be under American control.

The papers read before the American Street Railway association last week were of an eminently practical nature, but it will be noticed that they did not relate to mechanical and electrical engineering. Investments in street-railway securities, maintenance of car equipment and track, and train service—these were the subjects discussed. The power house and the various systems of operating the cars received comparatively little attention. This may be an indication that street-railway practice is approximating certain fixed standards, although it is not to be doubted that progress is constantly making in the design of power plants and in the distribution of current. A discussion on the use of alternating current for the transmission of power from one central source of energy, on long electric railroads, would have been timely and valuable, and it would have been interesting, too, if Mr. Vreeland and his associates in New York had furnished some practical data on the operation of conduit electric railways. Colonel Heft of Meriden, Conn., did, indeed, make one interesting statement. He is an old steam-railroad man, and, in discussing Mr. Yerkes' paper on street-railway investments, he asserted that he believed that the greatest benefits would come through the work of the mechanical and steam engineers. He said that he was horrified to find that for every paying passenger hauled on his electric railway he was carrying 721 pounds of dead weight, an amount exceeded on the steam railroad, with standard equipment, by only 137 pounds. He added that his company expected to have a car in operation within two months that would not weigh, with all equipment, more than 227 pounds for each passenger. This is certainly a very great reduction in weight of car equipment—nearly 70 per cent.—and should mean much to the load on the power house and to the wear on the track, if disproportionate sacrifices in other directions are not made to obtain it. However, the subject was not discussed after Colonel Heft's simple statement.

In general, it may be said that at this year's meeting the association discussed practical, every-day conditions, rather than technical problems.

Members and Visitors.

The following is a list of delegates from company members of the American Street Railway association, in attendance at last week's convention, arranged by cities:

Alton, Ill.—George D. Rosenthal, electrical engineer, Alton Railway, Gas and Electric company.
Amsterdam, N. Y.—E. F. Seixas, manager, Amsterdam Street Railway company.
Anderson, Ind.—Charles L. Henry, general manager, Char'es Berry, superintendent, and Albert S. Richey, electrical engineer, Union Traction company.
Atchison, Kan.—J. A. Bentlure, general manager, Atchison Railway, Light and Power company.
Atlanta, Ga.—E. Woodruff, president, J. R. Gordon, engineer, Atlanta Consolidated Street Railway company; E. Woodruff, president, and J. P. Smedden, engineer, Atlanta Railway Company.
Augusta, Ga.—C. O. Simpson, secretary, Augusta Railway and Electric company.
Aurora, Ill.—D. A. Belden, general manager, and C. C. Quackenbush, superintendent, Aurora Street Railway company.
Bay City, Mich.—E. S. Dimmock, general manager, and W. R. Morrison, assistant general manager, Bay Cities Consolidated Railway company.
Binghamton, N. Y.—G. Tracy Rogers, president, Binghamton Street Railroad company.
Birmingham, Ala.—J. B. McClary, general manager, Birmingham Railway and Electric company.
Boston, Mass.—Charles S. Sergeant, second vice-president, H. L. Wilson, auditor, J. H. Studley, jr., and John Balch, assistant engineer, Boston Elevated Railway company.
Bridgeport, Conn.—Andrew Radel, president, and James Butler, superintendent, Bridgeport Traction company.
Brooklyn, N. Y.—J. H. Vander Veer, superintendent of shops, J. S. Brackenridge, chief engineer, F. H. Shepard, manager of elevated equipment, and Giles S. Allison, sales agent, Brooklyn Heights Railroad company.
Buffalo, N. Y.—R. E. Danforth, superintendent, Buffalo Railway company; George Chambers superintendent, Buffalo Traction company.
Camden, N. J.—William S. Scull, president, and W. E. Harrington, general manager, Camden and Suburban Railway company.
Charleston, S. C.—Nicholas S. Hill, Jr., general manager, P. J. Balaguer, auditor, and G. B. Allen, director, Charleston Consolidated Railway, Gas and Electric company.
Chester, Pa.—Henry Moore, vice-president, and R. H. Beach, director, Chester Traction company.
Chicago, Ill.—E. R. Gilbert, general manager, A. E. Davies, superintendent, Chicago Electric Traction company; John McNulta, receiver, John Farson, president, H. M. Sloan, general manager, Edward H. Harrison, auditor, George H. Binkley, engineer, W. A. Harding, master mechanic and electrician, Calumet Electric Street Railway company; Charles T. Yerkes, president, John M. Roach, general manager, John Millar, master mechanic, Chicago Consolidated Traction company; D. G. Hamilton, president, Robert McCulloch, general manager, T. C. Pennington, treasurer, F. R. Greene, secretary, C. O. Nagle, assistant general manager, George W. Knox, chief electrician, A. C. Heidelberg, assistant superintendent, C. N. Duffy, auditor, Chicago City Railway company; William Walmsley, superintendent, South Chicago City Railway company; George A. Yuille, second vice-president, James R. Chapman, electrical engineer, Chicago Union Traction company.
Cleveland, O.—Charles W. Wason, president, Cleveland, Painesville & Eastern Railroad company; John Ehrhardt, assistant secretary, Albert E. Duty, assistant superintendent, and C. B. Easty, master mechanic, Cleveland City Railway company; R. M. Douglass, general superintendent, F. S. Barton, assistant secretary and treasurer, W. G. McDole, auditor, Charles W. Wason, purchasing agent, B. Maher, assistant secretary, and L. M. Wolf, assistant purchasing agent, Cleveland Electric Railway company.
Cincinnati, O.—G. B. Kerper, general manager, Henry Burkhold, private secretary, Cincinnati Street Railway company.
Colorado Springs, Col.—A. L. Lawton, general manager, F. C. Lawton, superintendent, Colorado Springs Rapid Transit Railway company.
Columbus, O.—P. V. Burington, auditor, J. W. McCord, Columbus Street Railway company.
Council Bluffs, Ia.—W. S. Dimmock, general superintendent, Omaha and Council Bluffs Railway and Bridge company.
Davenport, Ia. F. C. Denkmann, vice-president, James F. Lardner, secretary, John F. Huntoon, general superintendent, and John D. Fish, electrician, Tri-City Railway company.
Dayton, O.—George B. Kerper, general manager, and Nelson Routzahn, superintendent, People's Railway company.
Denver, Colo.—C. K. Durbin, general superintendent, Denver City Tramway company.
Des Moines, Ia.—George B. Hippe, general manager, and J. S. Goodvell, chief engineer, Des Moines City Railway company.
Detroit, Mich.—S. Hendrie, manager, F. A. Baker, director, Detroit and Pontiac Street Railway company.
Duluth, Minn.—Herbert Warren, general manager, Duluth Street Railway company.
Elgin, Ill.—William Grote, president, James R. Lane, vice-president, Charles Wuestenfeld, Elgin City Carpeonerville and Aurora Railway company.
Evansville, Ind.—H. D. Moran, vice-president and general manager, Evansville Street Railway company.
Findlay, O.—George B. Kerper, president, W. G. Nusbaum, engineer, and William Twining, electrician, Findlay Street Railway company.
Galveston, Tex.—F. W. Fratt, superintendent and engineer, Galveston City Railroad company.
Gloucester, Mass.—E. C. Foster, president, Gloucester Street Railway company.
Grand Rapids, Mich.—G. S. Johnson, president, Benjamin S. Hanchett, jr., assistant secretary and treasurer, Consolidated Street Railway company.
Hamilton, Ont.—C. K. Green, director, J. B. Griffith, manager, Hamilton Street Railway company.
Hamilton, O.—Will Christy, president, F. J. J. Sloat, general manager, C. E. Hooven, secretary, J. C. Hooven, director, Cincinnati and Hamilton Electric Street Railway company.
Harrisburg, Pa.—F. B. Musser, superintendent, Mason D. Pratt, engineer, Harrisburg Traction company.
Hartford, Conn.—E. S. Goodrich, president, Elmer M. White, cashier, Hartford Street Railway company.
Hazelton, Pa.—E. S. Doud, secretary and treasurer, C. A. B. Houck, electrician, Lehigh Traction company.
Houston, Texas.—H. F. MacGregor, vice-president and general manager, R. M. Johnston, stockholder, Houston Electric Street Railway company.
Indianapolis, Ind.—Charles Remelius, superintendent motive power, John Grant, assistant general manager, Indianapolis Street Railway company.
Jersey City, N. J.—E. D. Hibbs, auditor, North Jersey Street Railway company.
Johnstown, Pa.—H. C. Evans, director, Johnstown Passenger Railway company.
Joliet, Ill.—F. E. Fisher, superintendent, W. Huen, auditor, W. J. Kelsch, electrician, Joliet Street Railway company.
Kansas City, Mo.—Walton H. Holmes, president, J. A. Harder, auditor, William A. Sallertoo, superinteodent, Edward Butts, chief engineer, T. Blake, engineer, W. H. Miller, George Wing, Metropolitan Street Railway company.
Lexington, Ky.—E. C. Hathaway, general manager, E. A. Lenguere, engineer, Lexington Railway company.
London, Ont.—C. E. A. Carr, general manager and secretary, J. F. Hill, auditor, London Street Railway company.
Louisville, Ky.—T. J. Minary, president, S. G. Boyle, secretary, J. T. Funk, C. L. Christopher, superinteodent track construction, Louisville Railway company.
Lynn, Mass.—E. C. Foster, vice-president and general manager, Lynn & Boston Railroad company.
Memphis, Tenn.—F. G. Jones, vice-president and general manager, C. H. Ruddock, director, W. B. Mallory, director, Memphis Street Railway company.
Meriden, Conn.—N. H. Heft, president, William Tooker, engineer, Meriden Electric Railroad company.
Merrimac, Mass.—James T. Wattles, Haverhill & Amesbury Street Railway company.
Mexico, Mexico.—Arthur S. Partridge, engineer, Compania de Ferrocarriles del Distrito Federal de Mexico.
Milwaukee, Wis.—John I. Beggs, general manager, H. C. Mackay, auditor, F. Sargent, consulting engineer; T. E. Mitten, general superintendent railway department, Chester P. Wilson, engineer, George Kemmerlein, superintendent of transportation, W. H. Greenslade, assistant superintendent of transportation, S. G. Mitten, superintendent of overhead construction, E. Wolds, superintendent of maintenence of rolling stock, C. H. Lemon, surgeon, T. Simmons, roadmaster, T. G. Hoffman, clerk, Milwaukee Electric Railway and Light company.
Minneapolis, Minn.—J. F. Calderwood, auditor, F. D. Valentine, chief clerk, A. M. Baldwin, purchasing agent, Twin City Rapid Transit Railway company.
Montreal, Canada.—Duncan McDonald, superintendent, H. A. Brown, electrician, W. A. Ross, comptroller, Montreal Street Railway company.
Nashville, Tenn.—E. G. Conette, general manager, N. P. Yeatman, secretary and treasurer, Nashville Street Railway company.
New Bedford, Mass.—E. E. Potter, general superintendent, Elton S. Wilde, treasurer, Union Street Railway company.
New Brunswick, N. J.—E. H. Radel, secretary and treasurer, John Blair MacAfee, Brunswick Traction company.
New Orleans, La.—J. K. Newman, president, George H. Davis, manager, New Orleans & Carrollton Railroad company; C. D. Wyman, general manager, T. H. Tutwiler, engineer, New Orleans City Railroad company.
New York, N. Y.—H. H. Vreeland, president, A. C. Tully, purchasing agent, J. F. Kane, chief of construction, Metropolitan Street Railway company.
Oakland, Cal.—E. A. Heron, president, Oakland Transit company.
Omaha, Neb.—W. A. Smith, general manager, D. H. Goodrich, secretary, Omaha Street Railway company.
Pasadena, Cal.—W. H. Smith, Los Angeles and Pasadena Electric Railway company.
Peoria, Ill.—L. E. Meyers, secretary and general manager, Peoria and Pekin Terminal Railway company.
Philadelphia, Pa.—Henry C. Moore, vice-president, J. J. Mahoney, electrical engineer, Roxborough, Chestnut Hill and Norristown Railway company.
Pittsburg, Pa.—S. E. Moore, auditor, C. S. Mitchell, assistant auditor, United Traction company.
Port Chester, N. Y.—N. H. Heft, engineer, Marion Swing, assistant engineer, Port Chester Street Railway company.
Port Huron, Mich.—A. Dixon, president, H. A. Dixon, superintendent, City Electric Railway company.
Portland, Me.—William R. Wood, president, William A. Wheeler, director, A. Whitney, director, Portland Railroad company; Merle R. Griffith, electrician, F. C. Boyd, director, Portland and Yarmouth Electric Railway company.
Pueblo, Colo.—John F. Vail, general manager, Pueblo Traction and Electric company.
Quincy, Mass.—John R. Graham, president and general manager, Quincy and Boston Railway company.
Quincy, Ill.—H. E. Chubbuck, electrical engineer, L. A. Scovil, superintendent, Quincy Horse Railway and Carrying company.
Reading, Pa.—Samuel E. Rigg, superintendent, Henry C. Moore, director, United Traction company.
Richmond, Va.—Berkeley Williams, purchasing agent, Richmond Traction company.
Rochester, N. Y.—J. H. Stedman, manager of transfers, Rochester Railway company.
Rockland, Me.—George E. Macomber, president, Thomas Hawken, superintendent, William N. Todd, Rockland, Thomaston and Camden Street Railway company.
Saginaw, Mich.—L. M. Richardson, superintendent, Saginaw Valley Traction company.
St. Joseph, Mo.—J. B. Shirley, auditor, J. H. Van Brunt, superintendent, St. Joseph Railway, Light, Heat and Power company.
St. Joseph, Mich.—W. Worth Bean, president, H. C. Mason, superintendent, W. Worth Bean, Jr., assistant superintendent, St. Joseph and Benton Harbor Electric Railway and Light company.
St. Louis, Mo.—F. S. Drake, master mechanic, Cass Avenue and Fair Grounds Railway company; Jilson J. Coleman, general manager, Citizens, Missouri, Southern, St. Louis and Union Depot Railroad companies; Jilson J. Coleman, general manager, Samuel Barnes, electrical engineer, Lindell Railway company; T. M. Jeakins, general manager, G. J. Smith, master mechanic, St. Louis and Suburban Railway company.
Salt Lake City, Utah.—W. P. Read, general superintendent, O. P. Arnold, assistant superintendent, Salt Lake City Railroad company.
Schenectady, N. Y.—S. D. Greene, vice-president, W. Gibson Carey, Schenectady Street Railway company.
Scranton, Pa.—C. E. Flynn, general manager, Carbondale Traction company.
Sioux City, Ia.—Fred H. Fitch, general manager, C. M. Feist, master mechanic, Louis W. Price, cashier, Sioux City Traction company.
Springfield, Ill.—C. K. Minary, manager, T. H. Minary, electrician, Springfield Consolidated Railway company.
Springfield, O.—Fred Colburn, president, S. L. Nelson, general manager, L. O. Williams, superintendent, Springfield Railway company.
Syracuse, N. Y.—Ira McCormack, vice-president and managing director, Syracuse Rapid Transit Railway company.
Taunton, Mass.—John McClannel, assistant superintendent of transportation, Taunton Street Railway company.
Toledo, O.—Albion E. Lang, president, Thomas H. McLean, vice-president and general manager, E. J. Bechtel, superintendent construction, G. Munz, superintendent shops, Toledo Traction company.
Topeka, Kan.—Albert M. Patten, superintendent, Topeka Railway company.
Toronto, Can.—E. H. Keating, manager, Ewan Mackenzie, assistant superintendent, P. McCullough, electrician, Toronto Railway company.
Trenton, N. J.—Henry C. Moore, president, Charles Y. Flanders, director, Treoton Street Railway company.
Venice, Ill.—Fred. E. Allen, president, E. J. Spencer, secretary, Venice, Madison and Granite City Railway company.
Webb City, Mo.—E. J. Pratt, superintendent motive power, C. E. Baker, superintendent transportation, Southwest Missouri Electric Railway company.
Wheeling, W. Va.—W. A. Shirley, secretary and treasurer, Wheeling Railway company.
Wilkesbarre, Pa.—Thomas A. Wright, general superintendent, James Fagan, electrical engineer, Wilkesbarre and Wyoming Valley Traction company.
Wilmington, Del.—Henry C. Moore, vice-president, W. E. Boughton, director, Wilmington City Railway company.
York, Pa.—W. H. Lanius, president, York Street Railway company.
Youngstown, O.—A. A. Anderson, general manager and treasurer, Harry Dixon, assistant treasurer, James F. Uhl, Mahoning Valley Railway company.

The famous fruit belt of the Grand Traverse region in Michigan may in the near future be improved by an electric railway. The Traverse City, Peninsula and Old Mission Electric Railway company has been formed to build the road, which will run down the west shore of the peninsula, through the resorts of Edgewood, Bower's Harbor, Neahtawanta and Old Mission, and back on the east shore to East Bay and Traverse City, making a loop line. A branch along the west shore of the bay is also contemplated, which will touch Sutton's Bay, Omena and Northport.

Street Railway Accountants' Association.

In connection with the meeting of the American Street Railway association, the third annual convention of the Street Railway Accountants' association was held at Tattersall's on the mornings of October 17th, 18th and 19th. President J. F. Calderwood, auditor of the Twin City Rapid Transit company, Minneapolis, Minn., called the convention to order on Tuesday morning and introduced Mr. L. E. McGann, commissioner of public works for Chicago. Mr. McGann welcomed the association to Chicago in the name of Mayor Harrison. President Calderwood responded, and then gave his annual address, in which he called attention to the early history of the association and to the work before it at this convention.

The annual report of the executive committee was then presented and adopted. Secretary and Treasurer W. B. Brockway, secretary of the Toledo, Bowling Green and Fremont Railway company, Toledo, O., read his report, showing that 34 companies had been admitted to membership during the year, which brought the total membership up to an even 100. A resolution raising the annual dues of the association to $20 was adopted.

Wednesday morning's session was devoted almost entirely to the reading and discussion of a paper by H. C. Mackay, comptroller and auditor of the Milwaukee Electric Railway and Light company, Milwaukee, Wis. Mr. Mackay's subject was "Car Mileage," and he treated the question very exhaustively. Interesting discussions of the paper were made by H. H. Vreeland, president Metropolitan Street Railway company of New York; C. D. Wyman, general manager New Orleans City Railroad company, New Orleans, La.; C. N. Duffy, auditor Chicago City Railway company, Chicago, and others.

At the third day's meeting C. N. Duffy, chairman of the committee on "A Standard System of Street-railway Accounting," read the report of the committee, which was in printed form, and also presented a supplementary report. A report on the "Department of Blanks and Forms" was then submitted by W. B. Brockway. This paper was discussed at considerable length. Resolutions were adopted expressing the association's appreciation of the reception and hospitality shown the delegates by the city, by the local railway companies and committees and by the American Street Railway association.

The committee on nominations submitted its report, which was unanimously adopted, the following-named gentlemen being chosen to represent the association for the ensuing year: President, C. N. Duffy, auditor Chicago City Railway company; first vice-president, W. F. Ham, auditor Brooklyn Rapid Transit company; second vice-president, W. G. Ross, comptroller Montreal Street railway, Montreal, P. Q.; third vice-president, Elmer M. White, cashier Hartford Street Railway company, Hartford, Conn.; secretary and treasurer, W. B. Brockway, secretary and treasurer Toledo, Bowling Green and Fremont railway, Toledo, O.; executive committee, J. F. Calderwood, chairman, C. L. Wight and C. K. Durbin.

After a short speech by President Duffy and a discussion of the financial condition of the association, the association adjourned sine die.

Portsmouth Navy-yard Plant.

The Navy Department has entered into a contract with the Westinghouse Electric and Manufacturing company of Pittsburg for the installation of an electric-light and power plant at the Portsmouth, N. H., navy yard. The equipment will consist of two horizontal, tandem-compound, condensing engines of the Buckeye type. When running condensing, with 125 pounds initial steam pressure and 26 inches vacuum, these engines will develop 225 indicated horse power. They will have a speed of 250 revolutions per minute, and drive four compound-wound, direct-current, 125-volt dynamos, arranged for direct connection, with outboard bearings, of 75 kilowatts each, the top half of the multipolar frame being removable.

The switchboard will have one panel for each dynamo, one total-output panel, three feeder panels for lighting circuits and one power panel. Each machine panel will have one triple-pole, single-throw dynamo switch, with fuse connections on back of board, one field rheostat mounted on back of board with a handle and dial on the front, and one Weston round-pattern shunt ammeter. Each feeder panel for the lighting circuits will have one triple-pole, single-throw, 500-ampere switch, one 500-ampere circuit-breaker, and two triple-pole, single-throw, 300-ampere switches, with all fuse connections on back of board. There will also be two 50-ampere Weston shunt ammeters, each with a 10-point potential switch mounted below it. The power panel will be of 100-kilowatt capacity, and will be fitted with a double-pole switch, circuit-breaker and ammeter. The total-output panel will contain a circuit-breaker of full-output capacity, and the potential switches for voltmeters and galvanometers, and one Weston round-pattern ground detector (high-resistance voltmeter) with zero in center and scale for 250 volts each way.

The contract price for the complete installation is $18,227.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Cannon Valley Telephone company has been incorporated at Waterville, Minn.

The effort to establish a telephone exchange in Alden, Minn., has been abandoned, as it was not possible to get sufficient subscribers.

A meeting of the stockholders of the Minnesota Central Telephone company was held at Willmar, Minn. The president explained the reasons for the sale of the line between Willmar and Minneapolis to the Bell interests, and for the secrecy surrounding the deal, to the satisfaction of those present, and a motion of approval was carried.

A telephone line has been completed between New Paynesville, Minn., and Spring Hill.

A. T. Presson of Hudson, Wis., is after a franchise for a telephone exchange in Chippewa Falls, Wis., and is soliciting subscribers.

The St. Croix Valley Telephone company is extending a line from St. Croix Falls, Wis., to Butternut Lake.

The Mississippi Valley Telephone company has issued a directory of subscribers in Minneapolis, and has about 1,300 connections. The number is being added to steadily and supplements will be issued frequently.

The new telephone company at Beloit, Wis., is rapidly connecting its instruments with the board, and is giving partial service.

The new telephone exchange in Brookings, S. D., has about 65 telephones in active use and 20 more ordered. The full capacity of the board, 100, is expected to be taken up before the close of the year.

The Walworth County Telephone company has begun construction on a telephone exchange at Elkhorn, Wis.

The Western Electric Telephone company has connected with Fulda, Minn., Lamberton and other towns of that section.

The Badger State Telephone company has its toll lines working from Janesville to Madison, Wis.

The Citizens' Telephone company of Faribault, Minn., has succeeded to the interests of the Greene and Weston Telephone company, and will carry out that company's plans for a toll line to the Twin Cities. Construction is being pushed on the latter, and it is to connect with the Mississippi Valley Telephone company in Minneapolis and St. Paul. The line is expected to be in service within 30 days. Ultimately, this line will reach St. Louis on the south.

The Fosston (Minn.) Telephone company has received its long-delayed supplies and is now installing an exchange.

The council of Minneapolis contemplates an amendment to the underground-wire ordinance. As it now stands, poles are forbidden in the outskirts of the city, where there is no reason to object to them. The new system of the Mississippi Valley company will be seriously hampered if unable to set poles in the suburbs, and an amendment is contemplated to permit poles in the residence districts.

A. W. Bryant of Merrill, Wis., contemplates establishing an Independent telephone exchange for Chippewa Falls, Wis., and will ask a franchise.

George F. Miller, superintendent of the St. Charles (Minn.) telephone exchange, had an eye put out. A fire alarm sounded, and in aiding the department he ran into the end of a ladder, puncturing his eyeball.

The Michigan Telephone company will probably entirely rebuild the system at Houghton, Mich.

Messrs. Furtney and Drapes are applicants to the council of Eldon, Ia., for a telephone franchise.

Work has been begun at Waterloo, Ia., for a building for the exchange office.

The Iowa Telephone company has made improvements on the line from Bellevue, Ia., to Zwingle.

A. T. Presson will call his new telephone system at Iowa City, Ia., the "Home Telephone company." He has received a good supply of instruments and other materials, and will hurry work to completion.

The Northern Telephone company will extend its wires from Fonda to Storm Lake, Ia.

The Rocky Mountain Bell Telephone company filed its annual statement in Montana, showing assets of $1,031,340.91, consisting of construction, $756,865.74; supply department, $60,398.21; real estate, $152,185.84; stocks and bonds, $4,629.85; accounts receivable, $33,486.96; cash, $23,774.31. The liabilities are as follows: Capital stock, $774,000; surplus, $119,559.21; unsecured debt, $30,046.57; reserve, $51,873.30. Revenue balance, $55,861.83.

The Southeastern Iowa Telephone association has been formed at Ottumwa, Ia., and comprises all of the remaining Independent companies in that part of the state and includes over 1,000 miles of wire. Connections will be made which will give communication with Des Moines and other centers.

Funds are being subscribed at Miles City, Mont., to construct telephone connection between Miles City and various county points.

Hawarden, Ia., will vote on granting a franchise for a local telephone exchange.

The Independent Long-distance Telephone company has been formed at Clinton, Ia., with $10,000 capital stock. A line will be constructed to Maquoketa at once.

James McAdams fell from the top of a 40-foot telephone pole at Winona, Minn., and fractured several bones.

The Johnson County Telephone company has been incorporated at Iowa City, Ia., to construct lines through the county.

Little Wolf River Company.

A special meeting of the stockholders of the Little Wolf River Telephone company (Independent) was held at Weyauwega, Wis., on October 19th, at which the articles of incorporation were amended in several particulars. The more important changes made were increasing the territory to include the state of Wisconsin, increasing the capital stock of the company to $125,000 and increasing the board of directors to nine, including the president and secretary, who are ex-officio members. The directors elected were: J. A. Stewart, Clintonville, and O. O. Weigand, Shawano, term expiring January, 1900; R. W. Roberts of Milwaukee, Henry Boyle of Fond du Lac and Leander Choate of Oshkosh, term expiring January, 1901; F. H. Sweet of Fond du Lac and S. D. Boreham of Weyauwega, term expiring January, 1902. The president is E. H. Jones of Weyauwega; secretary and treasurer, A. L. Hutchinson, Weyauwega; vice-president, H. E. Kepler, Weyauwega.

The report of the company shows that since the annual meeting in January the lines of the company have increased from 148 miles to 493 miles, of which 366 miles are metallic circuit. The company has franchises in Green Bay, Stevens Point and Fond du Lac, and will cover the entire Fox River valley with lines as rapidly as possible. It is now completing an exchange in Fond du Lac which will have 400 subscribers before the end of the year, and it is the intention of the company to build exchanges in Green Bay and Stevens Point during the coming year.

Central Union Ruse in Sandusky Alleged.

Paul Miller has taken charge of the Central Union company's exchange in Sandusky, Ohio, and in commenting on the change the Star of that place makes this curious statement: "The deal as a whole simply means that a board of local directors will control the exchange here and get for their trouble 12 per cent. of the receipts. The company hires Mr. Miller to act as manager. The object of the Central Union or Bell people in making this change in its management is obvious. The local or Harrison company, owned and controlled by local capitalists, very rapidly and effectually took away its trade. The number of Harrison telephones increased monthly, with a corresponding loss to the Bell company. The reason for the change in subscribers was very probably the desire, most laudably, to patronize home industry. The Central Union people, in order to give their line the aspect of being on the same basis, have hired the following directors: James Flynn, C. L. Wagner, R. E. Schuck, August Schmidt and Col. W. W. Woodward. The name of the company, although in reality the old Central Union, will be changed to the People's or Citizens', in order to further carry of the purposes of the scheme. Andrew J. Mellen, whom Mr. Miller succeeds, will remain in the city for some time, until the Central Union company assigns him to another of its stations."

Proposed Telephone Intelligence Bureau.

President Morris F. Tyler of the Southern New England Telephone company, at Middletown, Conn., is said to be at work on the plans of a new branch of telephone work which it is expected will be a great convenience to the people of that state. He is considering plans for establishing experimentally in one of the large exchanges of the company an information bureau. Briefly stated it is President Tyler's idea to have an attendant in one of the exchanges around the state, either in New Haven or Hartford, whose business it will be to be informed concerning matters of current news concerning the state. News matters, such as fires, baseball games, boat races, accidents of all kinds, and in fact all things that people want information about, will be reported to the subscribers of the Southern New England Telephone company free of charge.

New Exchange at Wilkesbarre.

The plant of the People's Telephone company (Independent), Wilkesbarre, Pa., is now practically completed, and it is said to be one of the best in the country of its size. The company opens its exchange with 500 telephones and contracts for nearly 1,800 instruments. The additions will be made as rapidly as they can be installed. A branch exchange of this company is now in successful operation in Pittston, and a large force is at work on an exchange at Nanticoke. From these two points lines will be constructed on both sides of the river, uniting at Wilkesbarre. It is hoped that these lines will be completed by January 1st. To afford the company's patrons and friends an opportunity to inspect the plant a reception at the exchange on October 21st was given by S. E. Wayland, the company's manager.

Convention at Carlinville, Ill.

A circular has been issued calling for a convention of the Independent telephone companies of the central and southern portion of the state of Illinois at Carlinville on November 1st and 2d. The meetings will be held in the courthouse. An Independent state telephone association is already in existence in this state, but it seems to be the object of the Carlinville call to form another, and the president of the existing Illinois Telephone association is announced as one of the speakers. The call is signed by representatives of the Macoupin, Girard, Virden, Waverly, Auburn, Palmyra and Bunker Hill telephone companies, and J. A. Fletcher of Carlinville is particularly active in the arrangements.

In the language of the circular, "The objects of the convention are to organize a state association to meet annually and to connect all Independent exchanges in the state by long-distance toll lines, to establish rates whereby all may be able to use telephone lines, which includes farmers as well as people in the cities, and to regulate the construction of all toll lines in the state, that the same may be built with a uniformity, thereby guaranteeing perfect service in all connections; to adopt a constitution and by-laws for county companies in the state, the same not to conflict with the constitution and by-laws of the national organization; to form a bureau of information for the purpose of assisting all towns and cities desiring an Independent telephone exchange or Independent telephone lines, furnishing them all information as to constructions, cost, etc. Some of the national officers of the Independent associations will be here to assist in forming a state association. A program of addresses and discussions on subjects relating to Independent telephone lines and exchanges has been arranged. Mayor R. A. Hankins will deliver the welcoming address on behalf of the citizens of Carlinville. Among the other speakers who will address the convention will be Dr. I. A. Lumpkin of the state organization of Mattoon, Ill.; J. S. Connell of Chicago, Ill., representative of the national organization; M. A. King of St. Louis, Mo., representing the long-distance Kinloch system; Thos. W. Wilson, manager of the Mutual Telephone company of Springfield, Ill.; Arthur L. French, president of Illinois Telephone company, Chapin, Ill."

Plucky New Richmond.

Everyone will remember the terrible windstorm of June 12th, which practically destroyed the village of New Richmond, Wis., about 40 miles from the city of St. Paul. It was a calamity sufficient to discourage any small-sized community, but it seems that the people of New Richmond, including the backers of the local Independent telephone company, are not the kind to give up simply because their town is wiped out. A correspondent of the Western Electrician writes: "The big cyclone which destroyed the city of New Richmond also annihilated the People's Telephone Exchange company's new plant, which was opened last fall. Dr. F. W. Epley has purchased the franchise and is now rebuilding the plant in much better form than before for a complete metallic 24-hour service. W. J. Bonwell of St. Paul has the contract and declares that it will be a model plant in every particular. The city is being rebuilt with surprising rapidity and in very much better style than before. By the 15th of November, five months after the cyclone, every business place will be rebuilt with brick or stone, enlarged and beautified, and the whole city will be emphatically an up-to-date town in all respects."

NEW COMPANIES.

W. F. Wyatt of Independence, Texas, has organized a company for the construction of a telephone line from Independence to William Penn, and thence to Whitman.

John H. Traylor and J. T. Elliott of Dallas, Texas, and James H. Allen of St. Louis, Mo., have incorporated the Southwestern Texas Telephone company for the construction of a telephone line from Trinity to Corrigan, Texas.

The Denver Independent Electric Telephone company has been incorporated at Denver, Colo., with a capital stock of $500,000, by E. C. Miles, W. J. Smith and Z. T. Esmond. The objects of the concern are to construct and conduct telephone exchanges in the cities, towns and counties of Colorado, especially in Denver; to lease telephones, switches and the like, and to collect royalties therefrom; to collect tolls on telephone lines; to manufacture and deal in telephones, electrical supplies and the like; to erect poles for telephone purposes and to do all things which a corporation of its character is allowed to do under the laws of the state; to purchase and control other telephone lines, if desired to do so. The principal offices of the company will be in Denver, and these seven directors will serve for the first year: Z. T. Esmond, G. B. Fisher, N. C. Hughes, F. C. Miles, W. J. Smith, Douglass Washburn, G. W. Wright.

Notes of Exhibits and Exhibitors.

[*Continued from page 253.*]

It was regretted that M. J. Insull, second vice-president of the General Incandescent Arc Light company of New York, could not spare the time to attend this meeting and meet the many friends who were inquiring for him.

J. H. Cooke, Chicago manager of the Buckeye Electric company and the Jandus Electric company, mingled with the boys, and it is safe to say that the merits of the Jandus arc lamp and the Buckeye incandescent lamp were not forgotten.

R. V. Scudder and Charles Scudder, Jr., represented the Western Electrical Supply company of St. Louis. The company made no exhibit, but the gentlemen named did themselves proud in looking after the interests of the company.

The exhibit of the National Lead company was unique and attractive, showing a full and complete line of white lead and various babbitt metals. Mr. F. R. Cargill of Chicago and Walter H. Baker of St. Louis were in charge of the exhibit.

Gates & Randolph, the energetic western representatives of Triumph and Wairen apparatus, besides many other well-known specialties, entertained many visitors by taking them around the city in a handsome Waverley motor vehicle.

The McGuire Manufacturing company of Chicago made an impressive showing. Among the trucks exhibited by this company which attracted special attention was one of the 120 sold to the Havana Electric Railway company, Havana, Cuba.

A. C. Garrison, vice-president of the Columbia Incandescent Lamp company of St. Louis, who generally attends the electric-light and street-railway conventions, was unable to attend this meeting owing to press of business, which called him to New York.

An exhibit attracting considerable attention was that of the Continuous Rail Joint company of America, whose interests were ably looked after by the following-named representatives: W. F. Ellis, H. M. Montgomery, F. C. Schmitz, J. G. Miller and L. F. Braine.

The Chicago Wheel and Manufacturing company distributed a neat souvenir in the form of a small knife sharpener. Mr. Hatch, who represented this company as well as the Chicago Mica company, made many friends and added many new customers to his already large list.

The Arnold Electric Power Station company of Chicago was ably represented by President B. J. Arnold, General Manager W. L. Arnold and George A. Damon. These gentlemen received many congratulations on the excellent record the company has made in connection with its notable installations.

George Cutter, president of the George Cutter company, Chicago, or better known at the convention as "genial George," was a faithful and conspicuous attendant. Mr. Cutter met with gratifying success in pushing his street-railway specialties, which are so favorably known all over the country.

James Partridge, of Partridge carbon fame, was one of the most popular men at the meeting. It is safe to say that the interests of the Partridge Carbon Works were not neglected by Mr. Partridge. The company made a very nice exhibit, and it is said that not a few customers were added to its already large list.

A. C. Becken, the well-known jeweler of Chicago, made an exhibit of a full line of Paillard non-magnetic watches, which have been so favorably received by those who are engaged near electrical machinery. The exhibit was in charge of George A. Karr, who did much to make the Paillard watch better known.

The Street Railway Journal issued a noteworthy "World's Practice Number" for its convention issue. The book contained over 400 pages and weighed nearly five pounds. It was a well-printed and very large production, and attracted much attention. The Street Railway Review also issued a handsome souvenir edition.

The Lea Manufacturing company of Elwood, Ind., manufacturer of the Lea arc lamp, expected to send a representative to the convention, but at the last moment the press of business prevented. The interests of the company were well taken care of by the W. R. Garton company of Chicago, the western representative.

The Adams & Westlake company of Chicago made a very attractive and showy exhibit, consisting of headlights, signal lamps, car trimmings and electroliers. The exhibit was in charge of W. S. Bartholomew, assisted by J. W. Cross, E. H. Stearns, P. G. Emery, L. A. Gray, G. L. Walters, Clare Hester and W. S. Hamm.

With a record of over 7,000 cars in the country equipped with the Providence car fender, the Consolidated Car Fender company did not have to be introduced. A. C. Woodworth, general manager, and George Hollingsworth, general superintendent of the company, were on hand, however, to make new friends and renew old acquaintances and to distribute souvenirs. An ingeniously devised folder, illustrating the "life-saving features" of the fender, was much sought after.

The Standard Air Brake company of New York had one of the handsomest and most striking exhibits at the convention. The company showed a working exhibit of air brakes as applied to street railways. The following-named gentlemen represented the company: Manager Joseph R. Ellicott, E. H. Beecham, George E. Baker.

Much interest was shown in the announcement of the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind., which has just placed on the market its new arc lamp, for which special claims are made. Owing to the large demand already shown for this lamp the company was unable to make an exhibit at this convention.

E. R. Mason, western representative of the Cutter company of Philadelphia, in addition to other specialties, exhibited a Cutter circuit-breaker which breaks at 6,000 amperes. This is the new laminated wedge-type instrument, two of which have been sold to the "Alley L" road of Chicago, and are said to be the largest ever placed on the market.

The Gold Street Car Heating company of New York was represented by E. E. Gold, president, John E. Ward and F. de B. Weston of New York, in addition to E. H. Gold, Chicago manager. The company had an excellent working exhibit, consisting of a full line of heaters for street cars and private residences, which attracted much attention.

The Chicago Mica company had a neatly arranged booth at the head of the stairs in the gallery. A complete line of mica disks, tubes, rings, segments and samples was on exhibition, together with specimens of the well-known mica bond. Milton A. Snider, the president, and Frederick Hatch, the secretary of the company, represented the firm.

The exhibit of the Lorain Steel company of Lorain, O., and Johnstown, Pa., was well attended at all times. The company showed a line of du Pont single and double trucks, a controller, combining reverse and cut-out switch, and also unique type of flexible motor suspension. R. T. Lane, F. A. Merrick and O. D. Henry looked after the company's interest.

It was a matter of regret that E. H. Abadie and W. A. Layman of the Wagner Electric Manufacturing company of St. Louis could not attend the meeting, as there were many inquiries for both of these popular gentlemen. However, George B. Foster, the Chicago representative of this important company, was on hand and saw that Wagner interests were not neglected.

The Star Brass Works of Kalamazoo, Mich., exhibited a line of trolley wheels and harps manufactured under a patent process which they control. The wheels are made of the best grade of lake copper and especially treated for this purpose, which insures an unusually long life to the wheel and wire. Walter C. McKinlock is connected with this company and had charge of the exhibit.

The Taylor Electric Truck company of Troy, N. Y., made a very creditable exhibit, which consisted of an extra-heavy single truck, designed for heavy vestibule single-truck cars, one of the company's Empire State radial trucks, one of its regular swing-motion double trucks and an extra-heavy swing-motion double truck. The exhibit was in charge of John Taylor, manager of the company.

The Griffin Wheel company of Chicago had a very attractive exhibit, showing the complete car wheels that it manufactures, also sections of wheels showing chill. A striking feature of its booth was the hand rail, which was adorned with miniature car wheels, in halves. Mr. C. K. Knickerbocker was in charge of the exhibit, and was ever busy entertaining friends and distributing an exceptionally valuable souvenir.

The Leschen-Macomber-Whyte company of Chicago made an excellent showing. It exhibited its well-known galvanized strand wire, galvanized curtain cord, galvanized telephone wire, rubber and waterproof insulated wire and cables, Century tape and overhead line material. There was a large demand for its souvenir—a fine letter opener. George S. Whyte, F. B. Macomber and E. E. Robirds represented the company.

Nearly all the display samples of the Standard Underground Cable company were on exhibition at the National Export Exposition, but, nevertheless, a very good showing of the firm's productions was made by J. R. Wiley, the well-known manager of the western sales department. It was regretted that on account of the large business the company is now handling Vice-president J. W. Marsh was unable to be present.

The Siemens & Halske Electric company was ably represented at the convention by Charles E. Wilson, W. G. DeCelle, T. G. Harnish, W. G. Abbott and W. R. Mason. On account of the factory being in the city, no exhibit was made by the company in the hall, but visitors were cordially invited to inspect the works, and many availed themselves of the opportunity of seeing one of the largest and best-equipped electrical factories in the world. It was a matter of extreme regret that Mr. C. S. Knight, the general manager of the company, was prevented by illness from attending. He was missed by many friends.

An exhibit which attracted considerable attention was that of the Siegrist Lubricator company of St. Louis, in charge of Manager J. N. Edelin. Mr. Edelin showed unusual enterprise in attracting visitors to his exhibit, and during the exhibition he had a band of music, which was greatly appreciated. The Siegrist automatic oiling system, which was shown, is used in the Metropolitan railway plant in Chicago, besides in many other plants.

It was a matter of great regret that Mr. Arthur Warren, manager of the Westinghouse Electric and Manufacturing company, could not attend the convention. It would certainly have been a pleasure to him to note the great interest shown in the Westinghouse exhibit. However, Messrs. Hartwell and Probasco and the other Westinghouse men in attendance were indefatigable in looking after the company's customers and friends at the convention.

The Manville Covering company, Chicago, western representative of the H. W. Johns Manufacturing company, showed its complete line of street-railway specialties, electric heaters, Manville covering, etc. H. A. Reeves was in charge of the exhibit, and with the assistance of eastern representatives did much to increase the popularity of the company's products. R. H. Martin, president of the Johns company, was also at the convention.

The Warren Manufacturing company of Chicago was represented by Manager A. I. Warren. The Warren company manufactures a liquid pulley covering which is used extensively by electric-railway and lighting plants all over the country. Mr. Warren distributed a well-arranged pamphlet of testimonials from users, among which can be found such concerns as the Western Electric company, Chicago and Northwestern Railway company, Oakland Gas Light and Heat company, etc.

A new and attractive catalogue issued by the Speer Carbon company and distributed at its exhibit was much sought after, containing, as it did, a complete list of carbon brushes used on different machines throughout the country. Those who did not procure one at the exhibit can, upon application to the company, have one forwarded by mail. Many thousand samples of brushes were distributed among the delegates by Mr. Speer and Mr. Andrew Kaul, Jr., as well as very attractive souvenirs in the shape of a trick pocketbook and handsome leather cigar-case. Mr. Speer received the congratulations of his many friends who wished him well in his new enterprise.

An exhibit that was crowded at all times with representatives of the different railroad companies was that of the Christensen Engineering company, Milwaukee, which showed a complete line of the various apparatus it makes. One of the principal features of its exhibit was a complete air-brake instruction stand, showing the operation of the independent motor-compressor air brake, also an exhibit of special high-pressure air compressor made for the United States torpedo service, which was designed for 1,500 pounds pressure per square inch, and tested to a 4,000-pound pressure. Air hoists of standard type made by the Christensen company were also exhibited.

Something out of the usual run of exhibits was that of the Cylindorama Railway company. It displayed a working model of what the inventor, Sam Barnes, calls a cylindorama railway. The invention consists of a cylinder 200 feet long and 50 feet in diameter, upon the inside of which are convolutions of tracks. On these tracks operate cars with a seating capacity of from 12 to 16 passengers. While the cylinder is revolved the cars travel its length over the spiral tracks, passing en route between highly decorated and illuminated scenes, representative of the important sights of the world. It is claimed by the company that it has 130 orders for these railways, one of which will be erected at Sunnyside Park in Chicago.

An exhibit which attracted much attention was shown outside of the convention hall. This was a handsome car built by the St. Louis Car company for the Chicago City Railway company, with various parts contributed by other St. Louis manufacturers. The incandescent lamps used in this car were of the well-known Columbia type, manufactured by the Columbia Incandescent Lamp company of St. Louis. The company's four-coil street-railway lamp was shown. This lamp, with the aid of a reflector, gives great radiation and was greatly admired by street-railway men at the convention. George P. Rex, secretary of the Columbia company, did the honors for his house and left no stone unturned to increase the popularity of Columbia lamps.

Elmer P. Morris, manager of the Morris Electric company of New York, entertained a host of friends and visitors in a spacious booth, a unique feature of which was a little ante-room called "Forest Park Highlands." The exhibit of the Morris rail bonds attracted considerable attention, as did also the general line of materials manufactured by the different companies which the Morris company represented, among them being R. Thomas & Sons, high-tension insulators; Keystone Electrical Instrument company's instruments, Garton-Daniels arresters, A. and J. M. Anderson line material, Potomac terra cotta conduits, and General Equip-

ment company circuit-breakers. Mr. Morris was assisted by Mr. George C. Ewing, president of the company.

An interesting car-fender exhibit was that of the Hipwood-Barrett Car and Vehicle Fender company of New York. Archibald B. Dalby, president, and George Hipwood, treasurer of the company, assisted by George E. Weiler, the western manager, did the honors for the company. A working model and a biograph, displaying the practical working of the fender on the line of the Newton and Boston street railway, were noteworthy features of the exhibit. The rapidity with which this fender may be operated has been shown in a test on the above road. While the car covered a distance of two blocks, the fender was dropped, dummies were picked up and carried some 50 feet, then removed and the fender disposed of under the car, all in 25 seconds.

The exhibit of the Safety Insulated Wire and Cable company of New York was attractive and interesting. Col. E. J. Spencer, who represents the company in St. Louis, was in charge of it, assisted by M. B. Austin of the firm doing the company's business in Chicago. Sample boards showed interesting specimens of cable, including that used in Philippine and Cuban waters and the kind extensively used by the Metropolitan Street Railway company of New York in its underground work. The Safety company is very busy and is now finishing a new factory at Bergen Point to meet the requirements of its large business. Here it expects to have the best facilities in the country for submarine cable manufacture and shipment into the holds of deep-water vessels.

H. P. Cameron, the well-known electrical engineer of Syracuse, N. Y., made a small but attractive exhibit. Mr. Cameron was on hand to explain his method of assembling commutators, and it is needless to say that he received his share of attention from the visitors and delegates. Mr. Cameron has done business with many of the most prominent street-railway companies in the United States, and to show the success with which he is meeting it might be stated that he has sold over $7,000 worth of commutators in the last 60 days, to street railways. Mr. Cameron will be pleased to ship a commutator for inspection to any street-railway company in the United States, and if not satisfactory it may be returned, Mr. Cameron agreeing to pay the freight both ways.

Dixon's graphited wood grease for gears of electric-railway cars, graphite lubricators and flake graphite were displayed in the exhibit of the Dixon Crucible company. A specialty is being made by the company of the wood grease, which is new and said to be a better article than has ever before been offered railway companies. It is claimed that it prevents noisy gears and keeps the gears and bearings constantly lubricated. A large order of this article has just been sent to Alexandria, Egypt, to be used on the electric railway running to the second cataract of the Nile. An order has been received from Ceylon, India, and also one from Dublin, Ireland. A. L. Haasis, from the Jersey City office, Samuel Mayer, Chicago manager, and D. A. Johnson and W. B. Allen of the Chicago office, together with Mr. St. John, the western traveling agent, represented the Dixon company. A neat pencil was the souvenir distributed.

One of the most popular exhibition booths was that of the Pennsylvania Steel company of Steelton, Pa., and Q. & C. company of Chicago, its western representative. The Pennsylvania Steel company is one of the largest concerns of its kind in the country, employing 11,000 men in its two factories. Charles S. Clark, the Boston agent, and Mason D. Pratt, street-railway engineer for the company, represented the firm, whose exhibit consisted of frogs, switches, switch stands and a complete line of rail sections. Among the representatives of the Q. & C. company in attendance were C. F. Quincy, president; F. W. Edmonds, secretary and general manager; W. W. Holmes, superintendent; A. T. Kalas, C. H. Holbrook, I. Burnette, George Stanton and H. H. Vaughn. This firm's exhibit included rail and shop saws, steel car steps, jacks, drills, and the Q. & C. line of Stanwood tie plates. During the convention the Q. & C. company announced that it had just taken the agency of the well-known Magnolia metal. Stamp boxes and memorandum books were distributed as souvenirs.

Building Opposite Pole Line.

A man has the right to the use of his own property, which means every part of it; and such proprietor, the Supreme Court of South Carolina insists, is not to be stigmatized as encroaching upon the line of poles and wires of a telegraph or telephone company simply because he builds a house on his own land opposite to a pole and wires of such a company, located on a way or road opposite to such lands of a private owner. On the contrary, the court declares, in the case of Miles against the Postal Telegraph-cable company, that it behooves the company, in its legal use of a way or road, or even a highway or post road, to guard such use so that no injury shall result to the property of its owner, which may be located opposite such lines, through its negligence or want of due care.

Belden Enclosed Arc Lamp.

The accompanying pictures illustrate the new Belden arc lamp, manufactured by the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind. This lamp is the result of the combined experience of Mr. E. H. Belden, the inventor, and a number of arc-lamp users throughout the country. Mr. Belden filled the position of electrical engineer for a number of years with a prominent electrical manufacturing concern and made a specialty of the arc-lighting business. He has now associated himself with the Belden-Larwill Electric and Manufacturing company, which is placing his lamp upon the market.

The Belden arc lamp, of which an exterior view is shown in Fig. 1, has simple and light but very powerful mechanism and is said to give the largest possible life for one one-half by 12-inch carbon. There is no place in the lamp where alignment is necessary, and the clutch releases itself without striking a trip-post of any kind. No shadows are cast from the carbon points and dense globes are not necessary to obtain this result. There is an absence of metal of any kind on the inside of the inner globe, thereby preventing any chance of coloring the ashes that are deposited on the globe. At the start the flush of current is reduced to a minimum, and the peculiar construction of the dashpot allows the carbons to fall together instantly in case of the arc breaking or the current being shut off. The upper carbon is very heavily weighted, to overcome any possible friction.

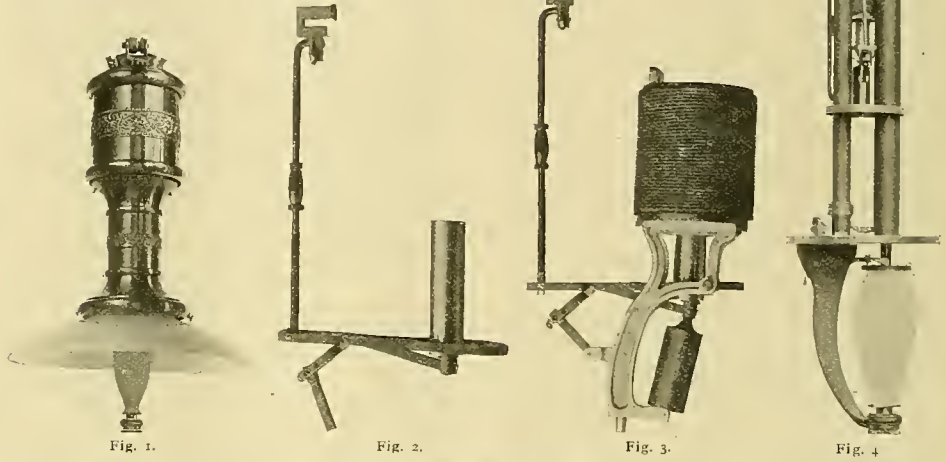


Fig. 1. Fig. 2. Fig. 3. Fig. 4

BELDEN ENCLOSED ARC LAMP.

By means of the toggle shown in Fig. 2 the magnet has an extraordinary leverage, thereby allowing the use of the heavy gravity pull. Every joint of this toggle is on a triangular pin or bar, thus making the movement the same as in a pair of scales, which eliminates all possible chance for friction on account of getting out of alignment or becoming corroded or gummed by the oil frequently used by some of the arc-lamp users. The hysteresis in the core has been reduced to a minimum, and the entire mechanism is so constructed that it can be detached as one piece from the lamp by the removal of a single screw.

By means of the toggle shown in Fig. 3 the carbons have a range of separation of over three times the distance at which they normally burn. No one can appreciate this point as well, perhaps, as the man who has had to stand and watch a lamp hiss and simmer away on account of the range of separation being so short that the slightest wear on the carbon rod or clutch has made it impossible for the carbons to separate far enough to form the proper arc.

All springs usually employed in the mechanism of arc lamps have been eliminated, thereby securing a permanent adjustment at all times, regardless of changes of temperature or length of time. There are no sliding contacts to corrode and cause trouble and no carbon rods. In fact, it is claimed that no part of this lamp needs cleaning or polishing at any time (excepting the globes), not even when retrimming, as no part of the lamp can become corroded or dirty enough to interfere with the proper working of the lamp.

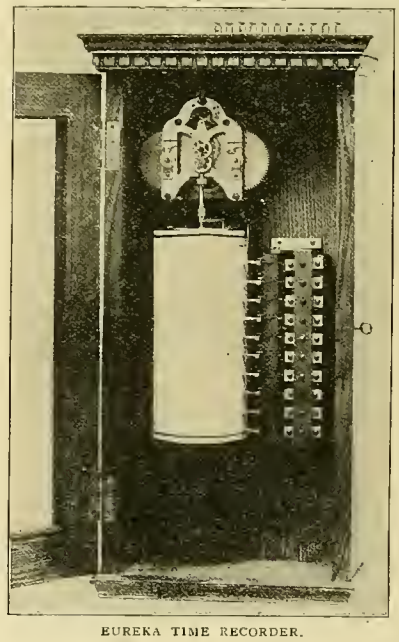
The lamp is short and very light in weight, and at the same time has an extraordinarily strong frame, as it is made of cold-drawn bicycle tubing brazed to stamped steel floors or platforms. The upper carbon suspending chain is carried by a sheave wheel, at the top of the lamp, which runs in ball bearings. These bearings have ball retainers, and, it is said, their construction is equal in every way to that of the bearings used in high-grade bicycles. The lamp is so insulated that when the current is on there is no uninsulated portion exposed. The shell can be easily taken off so as to expose the working parts, and the outer globe can be very easily removed, and when lowered is so arranged that it cannot be dropped or broken. Fig. 4 shows the lamp without its casing and outer globe. Burned-out carbons can be removed and the lamp can be retrimmed very handily, as it is not necessary to remove the inner globe. Both globes admit of easy cleaning.

Means are provided for centering the lower carbon and making the small bulb air-tight at the bottom, which have no tendency to crack the glass or get it out of center. The long, steady and powerful pull of the toggle produces no flickering of the light. An additional feature of the lamp is that it is danger-proof against fire. Its case is so designed that it may be used out of doors without a hood or any weather protection whatever, and it is also susceptible of artistic design.

It is contended that the most superficial observer cannot fail to be impressed with the general mechanical and electrical excellence of the Belden arc lamp, and that the most careful examination will but emphasize the first good impression. These lamps have been subjected to most rigorous and exhaustive tests, both for rough usage and delicacy of operation, and the company reports that not once have they failed.

Eureka Time Recorder.

The watchman's clock illustrated automatically records eight days' time on one sheet and in straight lines. The record impression is plainly visible. Dial and needle are dispensed with, and one improved portable magneto is used instead of several; hence, it is said that low cost is coupled with best results. The workmen's clock records the entire time of an employe on a single line. It dispenses with individual keys, cards, type wheels and tape. The numbers of employes are consecutive and not scattered promiscuously, as with tapes. Both registers are free from delicate parts and are as simple as a common clock. They are sold by the Columbia Electric and Manufacturing company, 79 Fifth avenue, Chicago.



EUREKA TIME RECORDER.

The finance committee of the Chicago City Council has rejected the proposition that the city employ a street-railway expert at a salary of $5,000 a year.

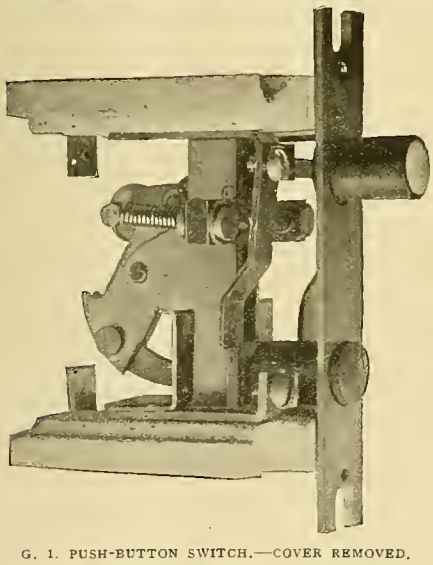
G. I. Push-button Switch.

The flush push switch manufactured by the General Incandescent Arc Light company is designed to go into any standard switch-outlet box that will fit any of the other makes of push-button switches.

In making porcelain parts for switches, where a box-shape base of porcelain is necessary, it is almost impossible to make porcelain, bake it and have it come out absolutely true, where the parts are thin, as in a box for an electric switch. This also makes the porcelain base very fragile, and if the porcelain box is broken or cracked the work of the switch is impaired. In the new switch the contacts are mounted on separate blocks of porcelain, which are straight and will permit of being made in a mold that will insure absolute uniformity in baking. Should the porcelain parts of this switch become broken, it is easy to replace the parts, without necessarily disturbing any of the other parts of the switch.

G. I. PUSH-BUTTON SWITCH.

The contacts on this switch have a capacity of more than twice the rated capacity of the switch, it is claimed, and the contact parts in the moving part, being in themselves movable, adjust themselves to insure a safe carrying capacity. They also clean themselves in the action of the switch.



G. I. PUSH-BUTTON SWITCH.—COVER REMOVED.

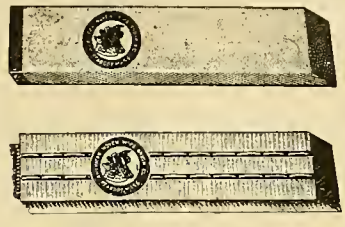
The mechanism is simple and is said to insure absolute certainty of a quick make-and-break of the contact parts. After the buttons have been pushed a certain distance, the making and breaking of the contact is absolutely under the control of the hand.

The parts of the switch are all made by tools, no casting whatever being used, thus insuring the desirable feature of having the parts interchangeable, so that repairs may readily be made by inexperienced persons. The switch is also designed to have an unusually large distance break, and can be used on 230 volts. A removable cover gives access to the working parts. This is an especially good feature, inasmuch as in a switch constructed in a porcelain box one may be unable to tell whether the contacts have been well made or whether there is any heating. Connection of wires is very readily made in this switch, the contact screws being readily accessible and ample space allowed for the leading-in wires.

American Woven Wire Brush Company's Product.

The illustrations give a general idea of the product of the American Woven Wire Brush company of Peabody, Mass. This concern is just introducing to the electrical field a series of different-sized dynamo brushes, which are claimed to have many advantages, both from the point of economy and successful operation. In general, the company makes two styles, which may be designated its standard copper-brush patterns, viz., the "American" and "American C," and an "alloy" brush, which is 80 per cent. copper. But the American company wishes it to be understood that in addition to the above styles it has a great range of manufacture and produces brushes suitable to the need of even the most fastidious dynamo tender. For instance, one may order a "stiff," "semi-stiff," or a flexible brush, as exactly suits his own particular need.

As a guarantee of the excellent nature of its motor and dynamo brushes, the American Woven Wire Brush company refers with considerable pride and satisfaction to the fact that its superintendent,



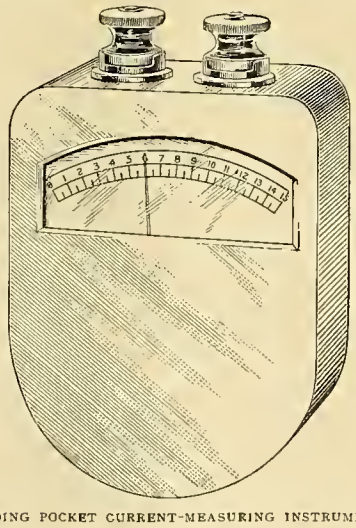
AMERICAN WOVEN WIRE BRUSH COMPANY'S PRODUCT.

J. D. Bacheller, has been devoting his time almost exclusively for seven or eight years in experimenting with and perfecting woven-wire brushes. For about a year and a half Mr. Bacheller has given attention to the American company's goods, and the factory in Peabody, with its present large capacity, is the best evidence of the favor which the company's brushes have met in the trade.

It is the purpose of the American company, as expressed recently by General Manager C. D. McDowell, to establish a western agency in Chicago, for the western field is promising, and cultivation of it, Mr. McDowell feels, cannot help but bring returns, especially with a meritorious article and one that has had such a thorough trial in the East.

Redding Pocket Current-measuring Instrument.

The accompanying cut illustrates a new instrument with a number of special features that has just been placed on the market by Jerome Redding & Co., 48 Hanover street, Boston, Mass. This "pocket current-measuring instrument" is designed, as the name indicates, more particularly for pocket service. It is of very light weight and is designed especially for electricians who desire a portable,



REDDING POCKET CURRENT-MEASURING INSTRUMENT.

accurate and inexpensive instrument which will at the same time stand some "hard knocks." The instrument is suitable for use by railroad signal-repair men, as it has a low resistance, is sensitive to the smallest current variation, is waterproof, and a lineman can throw it down on a wet railroad tie, or even in the mud, without impairing its efficiency. The instrument is nevertheless "full jeweled," it is said, and accurately calibrated. The device is built as ordered, to measure a "few volts," "many volts," a comparatively small current or a large one, as the customer requires.

Investments in Street Railways: How Can They Be Made Secure and Remunerative?[1]

By Chas. T. Yerkes.

The subject you have given me for consideration is one in which I take great interest, and for the very good reason that about all the investments I have are in street-railway securities. You can therefore see that my faith is great, for it is from our actions that we are judged.

My experience with street-railway securities dates back to a period almost 40 years ago, at which time street railways were in their infancy; in fact, you may say, in their swaddling clothes. It was in the early 60's, when the scientific operating of street railways was unknown, and, in truth, not dreamed of. In those days the men were worked from 16 to 17 hours out of the 24, and they, as well as the officers of the companies, did not seem to be aware of the fact that this condition could be bettered. The roads themselves were of a cheap character, and while intended to be permanent, they were far from it, but were equal to the demands of the public and requirements of street-railway transportation. In those days even a car register was unknown. The street railways in each city were owned by a few influential persons, generally men of large means, and the stocks and securities of the companies were but little distributed. Few people knew of their value or cared to have much to do with them. To hypothecate street-railway stock as collateral with banks was unknown, and it was not until 10 years after, in the early 70's, that the banks would look at them. The dividends in the meantime were generally fair, particularly with companies doing a large business in the thickly populated part of the cities in which they were located.

To my mind, the chief reason of the unpopularity of the investments was that the building of street railways in those days was always opposed by the people in the vicinity of the location, and particularly on the streets where the rails were to be laid. I remember very well the first track laid in the city of Philadelphia, where I then lived. It was the Fifth and Sixth street line. The people tore up the track at night which the company had laid during the day, and it was not until after there had been several riots, and the authorities had awakened to the fact that the law must be sustained, that the company was able to finish its road. The Chestnut and Walnut street line in that same city was bitterly opposed by the citizens, and everything was done in the Legislature and in the courts to prevent the charter from being granted and the tracks from being laid. And this has been the experience in most all large cities. Consequently, the people who were promoting the laying of street-railway tracks were looked on as sort of "freebooters" and their securities were regarded with much distrust. To some slight extent this feeling still exists, notwithstanding that there is scarcely a road which was laid years ago that could be taken up to-day without great objection being made on the part of the people.

It was not until the early '80's that street-railway securities were seriously considered as popular investments, and since that time their popularity has continued to increase as time developed the great resources which lie within them.

The quality of the street-railway plants of those days consisted in the kind of track, the condition of the cars and the class of horses which were used. These differed most materially. On some roads it looked as though the cars were never repaired or painted, and the broken-down horses were very much in the majority. Added to that, was the uneven rail, spiked to a string-piece, which almost made the rider seasick during a passage over it. Then, again, there were other companies where the track was well laid and kept in good order, the cars in good state of repair and well painted, and the horses of the highest class for their work. These two conditions were almost invariably the result of the adversity or prosperity of the different companies, and while the latter class—those that were prosperous—came to be sought as an investment sooner than the other, the anxiety of the public to so invest was never active. But about 1880, when consolidation of different roads came to be more in fashion and the economies produced thereby and also the studious consideration which was given as to how to operate roads, it was more a matter of reality. The attention of capitalists and the people generally was drawn to the stocks and securities of street-railway companies, and this condition has been on the increase ever since that time. The fact that great improvements have been made after the horse was relegated to a past era has had much to do with this, and naturally so. The mechanical propulsion of street cars has attracted the attention of the whole civilized world, and the question naturally arose in the minds of those who witnessed these changes, and who had money to invest, "Isn't this a good place to invest our money, and isn't there profit in it?"

The change in the mode of propelling the cars, and, in fact, the whole outfit of street railways has created what might be safely termed a "revolution." To look into the history of all the street railways

1. Read before the American Street Railway association at Chicago, October 17, 1899.

of 20 years ago and see the changes which have taken place is certainly wonderful. I can see before me a plant that was run with one-horse cars, a driver and no conductor, a pay-box in the front of the car, where the passenger was required to advance and deposit his fare. I see that line changed to two horses and obtaining the dignity of a conductor to collect fares from passengers. That was a great improvement, and then we had straw in the bottom of the cars in winter—not overly clean, because we could not afford to put fresh straw in every day, but still this was a luxury—an oil lamp at each end of the car, which supplied the double purpose of lighting the car and showing the signal on the outside. We went at the rapid rate of six miles an hour when we could make the car keep on the track. The motion of the car was most agreeable to a person who desired to ride on the billowy waves. We see this changed, so that the track was smooth, the straw was taken out, floor always clean, and a stove giving comfortable warmth placed therein in winter time. This was advanced luxury. We were pleased with all this, except when the snow would come, or the days were hot in summer, when the horses were not able to pull us to our destination.

We see another change. The great power of electricity was brought into use; the horses were gone, and instead of making our six miles an hour we could go twice that rate. The oil lamps were removed and electric lamps put in their places. As like begets like, the condition of the cars was improved. Cleanliness—always an adjunct to electricity—was substituted for uncleanliness. The districts of the city were expanded; lines were made in the suburbs, creating new towns, improving the property of the people, increasing the amount of the assessment on real estate, until we seemed as though we were living in another world. Aladdin's lamp did not produce any more wonderful changes; and this could not have been done had it not been that the attention of investors, both great and small, had been attracted to the street railways.

And what of the great benefits to the people? Instead of the slow, uncomfortable manner of travel, rapid and easy means are given. Points that could not be reached with the old system are brought within easy access. Everything is better and cheaper. While in days gone by it cost five cents to travel three miles, with the new improvement four times that distance can be traveled for the same money. Then it cost a person to ride about two cents a mile, now it costs one-half cent a mile. Why, then, I ask, should not a continuance of this condition be encouraged?

And now I come to the second and most important part of my subject, "How Can They be Made Secure and Remunerative?" To my mind, security is most to be considered. The remuneration must be brought about by hard work and close attention to the corporation. We cannot do much to increase our receipts. They come from natural causes. But we can control our expenditures, and that really is the science of street-railway management.

To make street-railway investments secure we must depend very much upon the justice of the people and the fact that we, as managers, are willing to do what is fair with the public. There seems to be an idea in the minds of many legislators that a street railway is a very simple affair and of very little account. This feeling has been engendered by their knowledge of long ago, and that knowledge has not advanced with the change in street railways. In fact, these changes have come and been accepted as such a matter of course that little attention is given to their worth.

The most important matter in regard to the security of street-railway securities is the length of charter under which they are operating. This question is of as much importance to the people as it is to the street railways themselves. The longer time that is given to a charter to run, the greater improvements and the more expensive plant can be operated by the companies. That is to say, the plant can be made more permanent than if the charter was of short duration, and naturally it would be. If a company has a charter with but a few years to run, the improvements will be of a cheap character, commensurate with the length of that charter, and the better the improvements, the better it is for the people, not only for those who own property, but for those who ride and have no property. We see this exemplified daily. Let us ask the question, How many bridges of iron or stone would the steam roads have if their charters ran for only a few years? There would certainly be none, and the speed of trains would be greatly reduced. Years ago 30 miles an hour was considered rapid traveling, with 20 as an average. Now the rate has been run up to more than 80, with 45 as an average on fast trains. This latter condition would never have existed if the steam roads had not had charters long to run.

Why should not the charters of street railways be equal to those of steam railways? In fact, considering them all in all, they should be longer. The cost of a steam railroad of to-day is not nearly equal to the cost per mile of a street railway, even counting all the appurtenances that go with each. One hundred years has been the time granted in this state for a charter to a street railway, and the municipality grants an ordinance for 20 years.

That this was wise or unwise at the time that period was designated I will not argue, but, considering that it was a proper time for what we had in street railways then, what was the outfit?—rails weighing 40 pounds to the yard, laid on a wooden string-piece, this string-piece laid on sleepers five feet apart, cars of a cheap class, a lot of horses, good ones, if you please, and a five-acre lot in the suburbs, where the car barns were erected. At the end of 20 years, if there was to be no renewal of the ordinance, and the charter was allowed to lapse, what would be the loss? The track, considering that it had been kept in good order, would sell for, say, 20 per cent. of its cost, the cars for about 30 per cent. of their cost, the horses for about 25 per cent. of their cost, and the real estate which had been bought by the company 20 years ago, and where, in all probability, a settlement had since gathered, would sell by the front foot, realizing, without doubt, 20 times as much as it had cost. There, you see, there would not be much loss if this road had to be given up.

But what are the conditions to-day? The street-car tracks are laid with heavier material than that used by the steam roads, the power houses cost hundreds of thousands of dollars, where the old structure cost but a few thousand, the electric plant on the cars and in the power houses and the wires and poles cost immense sums. So that it can truly be said that the electric plant cost more than 10 times as much as the horse-car plant. If, therefore, it was right to give a horse-car plant a charter for 20 years, the electric plant should receive a charter for 200 years and city ordinances to correspond.

It has been argued that if grants were made extending over a long period of time, other means of transportation might come into existence, and these charters would interfere with the adoption of these improved methods.

Let us suppose 50 years ago perpetual privileges had been given to operate exclusive omnibus lines in this city, or privileges of the same character had been given to operate ferries across the Chicago River. What would they be worth to-day? Long ago the charters would have been forfeited, simply for the reason that improved methods had rendered them worthless.

But while I feel that the legislatures should treat the street railways fairly, I also feel that the street-railway companies should treat the municipalities and states in the same spirit. I believe that a fair amount of the earnings of the companies should be given to the municipalities in which they are located. There is no doubt but that the street railways are of great benefit to these municipalities and to the people generally and to the property owners, but at the same time, it is my opinion that a spirit of liberality should be engendered by the street railways toward the municipalities for the reason that it is through the municipality that they are permitted to transact their business. It is a mutual benefit, with the burden on the corporation.

There is no doubt but that the extending of the lines in a large city is a great hardship to the railway company. There is little money to be made out of them for years, and while the company is waiting the property owners and people are being benefited. The very mention of the fact that a line is to be extended in a certain district causes advances in the value of real estate, and these advances are emphasized when the extensions are really made. There is nothing that has added so much to the health of the inhabitants of a city as the extension of street-railway lines. In this city the tenement-house district, which would have been a perfect pest-hole, is scarcely to be found. The prairies have been covered with street-car tracks, which forces the opening of streets. Cheap lots and cheap homes for the working people and the poorer classes, as well as the well-to-do, are everywhere in evidence. While there may be efforts to influence the people against street railways, they cannot but see these conditions, which are so plainly visible to them, and seeing them, fail to properly appreciate them.

I believe in educating the people, of whom the legislators are the representatives. Every state wherein there are large cities, which necessarily have important street railways, should have a commission appointed to ascertain the condition and requirements of this industry. The commission should be appointed by the governor of the state and should be composed of intelligent business men, of first-class standing, who are not interested in street railways. Under no condition should a person holding office, or who is ambitious to do so, be named. A man of this character is never to be trusted in any affair where courageous opinions are expected. The reports of such committee should have great weight with the legislators.

I believe that all corporations which receive their life from the commonwealth should be subservient to that commonwealth. There is nothing in their formation or general business which should not be reported to the proper authorities and be subject to investigation. I believe that the law should provide that an intelligent commission be appointed by the governor of the state in the same manner as is now done in this state in regard to the commissioners of the park system. The duties of this commission would be to see that the laws concerning street railways are carried out and that the companies have the protection to which they are by law entitled. The commissioners should have terms of 15 years, so as to insure their becoming experts, and receive such salaries as would enable them to live well and take care of their families in a good manner. They should understand, when appointed, something of the street-railway business, and as years pass by their knowledge would increase, as also their worth. They should have the power to dictate to the railway companies where new roads should be laid, if at all, and also the kind of new improvements to be used, when a railroad contemplated making any change in motive power. They should have the power to regulate the devices to be used for saving life and preventing accidents.

With an intelligent, honest commission of that kind, street-railway managers would be made more comfortable, the people would be benefited and the securities of the corporation would be more solid. The advice of these commissioners would be sought and the advice of such men, with the experience and knowledge they would naturally have, would be most valuable to any railway manager. Their reports would be explanatory, and much of the ignorance regarding street railways, which is fostered by our enemies, particularly in this part of the country, would be done away with.

To make securities more secure, we must have these different matters fully understood. We must do our business in a straightforward manner, with due consideration to the public, who are our patrons, continuing to increase facilities as opportunities offer, and adopting the most improved kinds of transportation which experience teaches is proper. And last, but by no means least, holding with the kindest regard our employes, who are faithful to us to the end, that there may be perfect harmony between them and the management, and seeing to it that our corporations are able to earn honestly a fair remuneration for the money, time, experience and labor that have been spent upon them.

Discussion.

After putting a motion of thanks to Mr. Yerkes for his paper, President Sergeant called on Mr. Wyman to open the discussion.

C. D. Wyman, New Orleans: Of the importance of sustaining and preserving the confidence and the faith of investors in the enterprises in which we are engaged there can be no question. When it is remembered that one-third of the invested wealth in civilized nations is to-day placed in steam and street railroads, and not an inconsiderable portion of that investment is in the street railroads, that we should secure and hold the confidence of our investors and that we should make their investments profitable is very manifest. The great search which now is manifest on the part of capitalists to put their money into street-railroad enterprises is one which should be met by a corresponding effort on our part to make everything plain, clear and distinct to them in regard to such enterprises. In the selection from a board of directors among our stockholders it is always customary, of course, to select men not only of financial responsibility in the community, but we always regard it as necessary and proper to select men of high probity, of reputation and of position. And if upon the officials of the company, the managers and the directorate, there is made emphatic, in the eyes of the public, this feeling of responsibility to the public and also the equal responsibility to their investors and the capitalists, the impression is wise, beneficial, and tends, moreover, to the extension and expansion of our business; for I take it that in this respect at least we are all expansionists.

We should be frank, free and open with our investors. We should tell by means of circulars, of statements, of various methods of publication, of our operations and results, and state the truth, the exact truth as near as we can ascertain it, to all those interested in our respective companies, whether they be interested to a large or small extent. While it is possibly true that complete disclosure at all times of the policy of the company might thwart it unjustly and unreasonably, I still do hold to the idea of publicity. Now, much more than formerly, the results of our work are being set forth constantly and freely, and I believe that the more this is done in a proper and complete manner the more we shall secure and retain the confidence of our investors and likewise secure their further investment with us and induce them to increase their holdings with our enterprise.

We often have what are known as "panics"—a sort of neuralgia that pervades the financial market—springing from a want of confidence. Actual values are not disturbed; speculative values are. We may, to some extent, ward off any such feeling, any disquietude on the part of our investors, by letting them know the facts so far as we are able to do it, and give them frankly and freely our judgment as to our present condition and our anticipations of the future, with reference to the enterprises with which we are connected.

I also believe we should adopt, so far as possible, a plain, simple and thoroughly understandable method of bookkeeping, and I am therefore most heartily in accord with this Accountants' association, now, I believe, in session, which is endeavoring to do precisely that which I am endeavoring to speak of. The average stockholder becomes very much muddled, oftentime, when he attempts to study the question of what we shall charge to operating expenses and what shall be charged to permanent expenditures, and therefore to investment. So far as it is possible, such a system of bookkeeping and recording of expenses

should be adopted as will make everything clear and thoroughly comprehensible to his mind.

I would also call attention to the question of depreciation and the provision for it. I am exceedingly glad to see that some of the railroads, and notably the Milwaukee Street Railway company—presided over by so able a manager as Mr. Beggs—have taken up this question of depreciation very carefully, very particularly, and have taken into account the depreciation of the different mechanical parts entering into the physical equipments of the roads. They are setting aside annually, as I understand it, a certain amount of money from their receipts, to make good that depreciation. Many electric railroads, or, for that matter, cable railroads, recently converted from horse lines are liable to lose sight of this fact for the first few years of their operation. Their receipts naturally increase and their expenses may be at a very low ebb, by virtue of the fact that everything they have is new and the era of repairs has not set in. It seems to me, therefore, that it is unsafe, from the results of that particular year or some other year, to predicate what the earning power of the company is going to be, to publish to the stockholders that that might be always expected. While it is always to be hoped, of course, that the increase of receipts will take care of the repairs and depreciations, nevertheless, if we can make certain and absolute that point by studying out what this depreciation is, what this life of the equipment is going to be, we shall be on the safe side, if we begin to provide for it, and tell our investors that that is what we are doing, from the initial roll of the first wheel on our lines.

J. I. Beggs, Milwaukee: I feel deeply interested in this subject because I am in a similar condition to that stated by Mr. Yerkes. I am charged with the responsibility of managing what is becoming one of the larger street-railway systems of the country; but I am more than that, Mr. President, and have, therefore, given to this matter the most close and careful thought. I can say with Mr. Yerkes that all I have in the world is in street-railway property. I am, therefore, particularly interested in the security of these investments.

Taking the property of which I am now speaking, the franchises have a little over 20 years to run, and yet we are discussing it, as they are in some other sections of the country, trying in advance to make calculations as to the franchises, to know how much we are justified in putting into that property; how long we have in which to get a return from it. I do not know that it is being done so methodically by other properties—it may be. I believe you will recognize that it is a proper charge against earnings; that you have a right to set aside this amount before the public can demand that you shall give greater accommodation for the carrying of a passenger 12 or 15 miles, to which Mr. Yerkes has alluded, or that the fare shall be reduced. We are setting aside a certain amount for this purpose. I desire to throw out, in connection with this paper of Mr. Yerkes, the thought that we want to make some provision for the time that these bonds of ours will mature. In the case of the Milwaukee property, our bonds do not mature until two years after the expiration of the franchise.

Now, as to the other point suggested—as to the security—because I have always believed in holding this security myself; I do not want to have anything to do with a thing that I cannot put my own means in—I want to know what provision has been made to pay them. Is there any sinking fund being set aside by your companies to take care of these various investments when they shall mature? Gentlemen, you must make proper provision for your property, by looking forward a very few years, when they will have to be thoroughly reconstructed from the ground up. I estimate that we replace 10 miles of track every year, and that is not conservative at all, because we have got about 150 miles of road in the city limits, and I estimate that it will last 15 years, which no road has done thus far; therefore, we must put down 10 miles per annum to make it good. We estimate our rolling stock in the same way. It is a wonderful thing to tell, not only to the specialist, but to any business man or to any court, and it was very influential in the argument where the city tried to make us give four-cent fares, that with proper maintenance of our system we could not do it, although, if we had taken the figures as they appeared on their face, our earnings would have seemed to be sufficient to warrant a reduction in fare; but they were fictitious; they did not represent our normal repair condition, as it was. The longer time our franchises have to run the more you can afford to spend upon the betterment of your system, the greater the facilities you can give. We are merely merchants, as Mr. Yerkes stated, in selling transportation, and we must make the practice of, as I sometimes use the phrase, "provoking the public to ride." It seems necessary to me, in order to give security to these investments, to make some provision for the bonds when our franchises have expired and when you cannot earn the interest on them, to say nothing of the principal.

H. H. Vreeland, New York: There is a thought in connection with Mr. Yerkes' paper that occurred to me when he suggested the question of management—the consideration not only of the average revenues, but the average of expenditures; that is one of the very strong points that appeals to the confidence of investors and the general public in properties. The great steam railroads of this country, with which the greater part of my life has been spent, have created a confidence in and permanency of management. Secure the proper man to manage the property. It is really more important in the street-railway interests than it is in steam railroading, from the fact that in the steam road the directors do direct. There is not very much done in street railways in that direction. The manager is elected and put to work and allowed to run the property. He does not get much help, and he has to be a man who can meet the local municipal conditions, the state conditions and the general conditions as affecting the properties, as far as the legislative and municipal affairs are concerned. He has to be a man who can take care of the financial part and of the operating side, and he has to do it with very little assistance.

The next thought that occurred to me was what my friend, Mr. Wyman, suggests, and it is a very important one—the question of publicity. Coming out of the school where we are taught—were taught for years—not to submit a report to your directors or president without analyzing it thoroughly, not simply showing that the train tonnage increased so much, mileage increased so much, revenue decreased so much, but went to work and analyzed it, and the same with reference to passengers—coming from that school, then, I was surprised to find how very little of that there was connected with the street-railroad system. Consolidations have reached a point where our securities, by reason of recapitalization and reissuing of bonds, necessary, have come into the hands of the investing public, and the managers are the caretakers of the property, not of the few, but of the many. But it is necessary to let people know what they are buying and what values they are getting to determine whether it shall be made into a fund or be a different proposition. The number of the stockholders in the large corporations, I am glad to say, is increasing very rapidly in the different properties with which I am connected. The increase in the average number of stockholders has been very large. In the Metropolitan Street Railway company the increase has been over 150 per cent. in the last 10 or 15 years, both in the increase of capitalization and the bringing in of new investors. At the present dividend we had 130 more stockholders than we had at the last dividend three months ago, and not one of them held over 100 shares of stock in the increase, and they are residents of New York city. That is one of the greatest elements of strength in the handling of this property where we have to meet with the municipal and state question—a common interest with citizens in our properties—located in the properties themselves. It assists and helps out with the question, gains friends for the property and assists very materially in the management.

There is one further point that Mr. Yerkes suggested, and that is the labor question. It is the life of the street railroad. All other matters connected with the property are insignificant. The financial side, the transportation side, except as represented by labor, are insignificant, as compared with the great problem of handling labor. In the large consolidations there are, say, 15 or 20 different lines in which the employes have been handled under the theory and ideas of as many different managers, and you see how difficult it is to bring that body together, to try to get them responsible to one man and responsive to one method of management. It is a thing that requires a great deal of energy and ability, but it is a thing, if once accomplished, that gives the public to understand that the manager is managing the labor problem and not the agitator. And if you can get that confidence, you must adopt the same policy of the agitator, and take the platform that he does when he talks in his interests, and decide that it is just as valuable to the manager to go on that platform and talk to them in his interests. The success of the investment is in the confidence of the stockholders and the general public that there is no crisis going to confront the property this year or next, that may not only wipe out the dividend, but mean the wiping out of the entire earning capacity for that period and the disturbance of all the smooth working conditions that is necessary to have at all times.

E. C. Foster, Lynn, Mass.: In Massachusetts we have a board of railroad commissioners which has supervision of the movements of the street railways. A franchise is granted to a corporation without limitation. To be sure, it is subject to revocation by the local boards, approved by the railroad commissioners. But, of course, it would seem absurd on the part of the Board of Railroad Commissioners to revoke a charter on which they had approved the issuing of securities. Their approval is set upon the securities as a seal; also the amount of securities which are issued, or may be issued, is limited; they have the power of limitation. I do not say, gentlemen, that the laws of the state of Massachusetts are superior for the operation of street railways to those of any other states; but I do feel that the investors are protected. Street-railway stock in any of the home companies, I believe to be a security which will justify anyone in investing in it, on account of its permanence. To be sure, we are subjected to the caprice and whims of the local authorities to a certain extent, but that is limited by reason of our right of appeal to the Board of Railroad Commissioners.

Mr. Yerkes: May I be permitted to ask the gentleman a question on one point he made? I understood from him that the grants of street railroads are liable to revocation at the instance of the local authorities, confirmed by the commissioners. Is it not a fact—and this I merely ask for information—that the courts have decided that these revocations cannot be put into effect unless it can be shown that the roads are not needed by the people?

Mr. Foster: The authorities would have to show that public necessity and convenience required the removal of the tracks; otherwise they could not do it.

Mr. Yerkes: It would be a pretty difficult thing to get the tracks up after the people once became accustomed to the use of the cars.

Mr. Foster: I do not know of its ever having taken place, except in one instance. I think there was a leased road where they undertook a revocation of the location. It was revoked, and another was substituted for it. It was not a complete revocation.

N. H. Heft, Meriden, Conn.: I believe that the greatest benefits will come to the street railroad through mechanical and electrical engineers, in improving the present equipment of the road. I believe that sufficient attention has not been paid to this matter, and in a great many instances we have run mad on the question of rails and the question of car equipments. In going over the question of weights that we are drawing to-day, I was horrified to find that for every paying passenger hauled with the modern street-railway equipment, we were hauling 721 pounds of dead weight, exceeded by the steam railroads only to the extent of 137 pounds, with their standard steam-railroad equipment. I think it behooves all street-railroad managers to turn their attention to the question of equipment, to see if they cannot get rid of some of this weight; and we expect to operate within the next two months a car, including the entire equipment, that will not exceed 227 pounds per passenger.

Electric Power Plant in Goodrich Rubber Works.

The B. F. Goodrich company, the well-known rubber manufacturer, at Akron, Ohio, is substituting electrical power to take the place of its present steam drive. It has been operating a factory which has grown from time to time, the power for the additions having been secured from steam engines placed where the power was required, and the supply of steam has been mainly from a large battery of boilers, supplemented by other boilers situated in different places. An extension is about to be made to the factory, covering a considerable additional area. This has necessitated an additional steam plant. The problem arose whether to add to the boiler plant, or to consolidate all the steam-generating apparatus into one central power house, and then distribute the power to the factory electrically. It was found that the latter method was the more economical, and it has been adopted.

Current for the lighting of the factory has been supplied from dynamos of small sizes, placed at different points. Some eight or 10 different machines of small sizes and various makes have been employed. These will be discarded and the lighting and power all taken from a common system. The Westinghouse Electric and Manufacturing company will supply the entire electrical equipment, which is being installed under the direction of Mr. E. C. Shaw, electrical engineer to the Goodrich company, with whom many of the ideas embodied in the plant are original. The electrical apparatus is already well advanced and the early spring should see the plant in operation.

The engine and boiler houses will be of steel construction; the former 130 by 80 feet, with coal bunkers overhead having a capacity of 800 tons. The boilers will aggregate 3,000 horse power and be equipped with mechanical stokers and coal conveyors, to secure economy in labor and fuel consumption, and also smokeless combustion. The engine room will measure 124 by 50 feet, and contain three compound-condensing high-speed Corliss-type engines, direct-connected to three Westinghouse two-phase generators, two of which will be of 500 kilowatts and one 150 kilowatts. The three generators will be arranged to work in multiple. This central power station will supply the electric-lighting system throughout the buildings, and furnish power to Westinghouse induction motors scattered over the departments of the works. A very elaborate switchboard has been built by the Westinghouse company, to provide for the multiple running of the generators and to control the circuits for lighting and power. Each power circuit will be furnished with a two-phase Westinghouse integrating wattmeter to register the exact amount of power used by each department of the works. The engineer in charge will be able to read the total amount of power supplied.

About 60 motors will be installed, varying from 300 horse power to one horse power, with an aggregate capacity of 2,000 horse power. Some of these will be attached directly to individual machines, such as tube mills, calender rolls, elevators, etc., each machine having its separate motor. The lighter machines will be connected by belts to shafting and a single motor will drive a group of them.

The primary object in this departure by the Goodrich company is to secure the economy in operation which an electrical drive affords. Sixteen separate steam engines will be supplanted and the power plant concentrated under one roof. In a large factory like that of the Goodrich company it is expensive to operate separate steam engines, as the loss by condensation and leakage of steam pipes is a serious item. Under the new system, electricity will be carried by feed wires to all parts of the works and converted into mechanical power by electric motors. Experience in many industries has shown that the electrical drive economizes three-fourths of the power that was required for operating steam engines. Another signal advantage of electrical operation is its flexibility as to extensions, which can be effected by simply adding further generating units and the necessary additional wire feeders.

Construction and Maintenance of Street-railway Tracks.[1]

By Edward Butts.

The construction and maintenance of street railways involves two words, construction and maintenance, which are inseparable in considering a street-railway enterprise relative to capital.

Is the street railway to be built for temporary purposes? Is it to be built simply to float on the market or to turn over to our successors and assigns, or are we to build a street railway to endure to the extremity of the present advanced stage of science, speaking particularly of the use and durability of materials?

The latter view will be accepted in preparing this paper.

In the matter of street-railway construction, the first thing is to consider carefully all the local influences which may become a factor in maintenance or involve future changes, and so considering the subject from this fundamental position, the question naturally evolves into urban and interurban street-railway construction.

It is desirable in all cases to construct the street railway in such a manner that when the time comes making it necessary to reconstruct the interurban portion, the termini at the same time shall need the same attention, and as a general proposition the urban end of a line is the governing factor when durability becomes the question. This is obvious, for the reason of ramifying lines and concentrated travel.

For the present, then, we will consider urban roads from a standpoint created by practical experience and expenditure of capital.

The rails should not be less than six inches in depth, with a width of base equal to the exposed upper surface. Where streets are paved with asphalt and a stone toothing course placed adjacent to the rails, the rails must be at least nine inches in depth, in order that the base may be securely imbedded in the concrete below. Rails should be center bearing and rolled in 60-foot lengths and handled so that they will be perfectly straight when placed in final location.

Tie rods one inch in diameter shall be placed six feet center to center, along the line, supplied with hexagon nuts, which, when in place, shall clamp the rails securely on both sides. The tie rods threads should extend far enough from the rod ends to allow the rod to be put in place without bending same. The theory of this rigid tie rod is that the street traffic and pressure on the outside of the rails should be provided against, as well as the car thrusts on the inside. The top of the tie rod should be placed at the center, between the top and bottom of rails, better to accommodate the paving, especially if brick or stone is adopted for the wearing surface.

The construction for rail foundations consists of digging a trench 20 inches wide on top and 16 inches wide on bottom by enough depth to get six inches below the rails when same is to established grade.

In this trench, at 10-foot intervals, are placed wooden blocks, eight by 10 by 16 inches, and the rails spiked securely to these blocks, which serve to hold the rails while same are being laid and tamped to surface, the joints being held in position by temporary splices.

After nicely gauging, aligning and surfacing the track, the trenches are filled with concrete, bedding the base of the rails up to the bottom of the proposed paving.

This concrete which is placed in the trenches around the rails is composed of crushed stone measuring not more than one-half inch in greatest dimension, mixed with Portland cement and domestic cement and sand.

The quantities of the above are mixed, two parts sand, one-half part Portland cement, one-half part domestic cement and five parts crushed rock, all by measure. Great care should be taken to get the mortar flushed close against the rails and bring same full up under rail trams. The concrete in the trenches should be allowed about six days to set; however, this depends upon the condition of the atmosphere, as it sets much more rapidly in warm than in cold or chilly weather.

The concrete for paving foundation may be composed of one part domestic cement, two parts sand and four parts broken stone by measure, the broken stone to be not larger than 2½ inches in the greatest dimension.

All concrete to be thoroughy tamped till mortar flushes to surface.

After the concrete has set cast-weld joints shall be formed at all joints, including the special work which may be needed.

The cast-weld joint on 80-pound rails should weigh 150 pounds, and on 100-pound rails 200 pounds additional metal, the additional metal to be composed of two-thirds pig-iron and one-third common scrap-iron. The metal should be heated to a bright yellow temperature and each joint formed with one pouring. The depressing clamps should remain in place for at least one hour after the pouring, and the surface of the rails finally dressed smooth, so that the transition of the car will be the same as a continuous rail. In preparing the joint better result as to smoothness is obtained by inserting a thin shim between the rails than placing the rails too close to admit said shim. These cast-welded joints should be so formed as to admit the wearing surface of the pavement with least amount of interference practicable.

As a general proposition, the wearing surface of the paving should be composed of the same material as the balance of the street; otherwise there will be an undue amount of vehicle travel on the street-railway tracks, and consequently more frequent accidents will occur, as well as a more limited durability to said wearing surface.

For instance, if the street is paved with asphalt and the track with brick or stone, heavy loads on slight grades will be driven on the stone or brick, for the reason the latter material furnishes a better footing and keeps the grease well in play in the wheel boxes. On the contrary, if the street-railway tracks are paved with asphalt and the street roadway with brick or stone, the drivers of light vehicles will immediately seek to occupy the street-railway tracks, as well as some of the other class.

At all times attention should be paid to drainage, and at street crossings where the established grade is level the surface of the tracks on one side should be elevated several inches, to prevent the retention of water pools.

At all changes of grade the rails should be bent to form vertical curves and no joints allowed in said vertical curves, as it is almost impracticable to form a uniform curve unless shop work is resorted to.

There is no economy in trying to construct a railway too hastily, as in so doing inferior work is generally entered and a future expense the result.

The special work, turnouts, crossings and crossovers should be of cast-steel construction, except steam-railway crossings, which is best of regular built-up work located on the foundation. The tongue of turnout switches should be placed on the high or superelevated rail of the curves; otherwise the guard rail of the mate should extend full length of casting on which the tongue is located. All curves of a radius under 300 feet should be provided with guard rail, and curves of less than 50 feet radius should be double-guarded.

A very important item as a matter of economy in the construction of street railways is the contract and specifications. This document should cover, without doubt, all that is intended to complete the whole line, and in street-railway construction there is so much to consider that often items are left out or neglected which finally become very serious and costly matters.

In the matter of maintenance, when a line is constructed as herein provided the maintenance question is thrown almost entirely on car equipment, involving the several items, wheel base, double or single trucks, diameter of wheels, properly applied springs and height of cars.

The longer the wheel base the less durable the curve.

Single trucks will batter out frogs, switches and joints more rapidly than double trucks. This last also applies to diameter of wheels, weight of cars, and last, but not least, the springs beneath the trucks and car body.

1. Read before the American Street Railway association at Chicago, October 19, 1899.

CORRESPONDENCE.

New York Notes.

New York, October 23.—The section of the Third Avenue railroad from the power house at Sixty-fifth street to One-hundred-and-twenty-ninth street was shut down at two o'clock yesterday morning, and the work of changing it from a cable road to a conduit electric line was pushed forward with great rapidity. It was expected by Superintendent Robertson to have the cars in operation this morning.

At a meeting of the new board of directors of the Electric Vehicle company chosen at the recent annual meeting of stockholders, R. McAllister Lloyd was elected president, in place of Isaac L. Rice, who retired owing to other pressing business. An executive committee, composed of Isaac L. Rice, John Jacob Astor, George H. Day and Martin Maloney, was chosen.

It is rumored that at a special meeting of the stockholders of the Kings County Electric Light and Power company, which has been advertised for October 30th, the long-talked-of consolidation of the electric-light and power business of the borough of Brooklyn with that of the borough of Manhattan will be consummated through a transfer of the company's stock to William C. Whitney's New York Electric Light, Heat and Power company. The report, however, has been denied and the further statement made that the meeting has been called for another purpose.

Mr. Frank J. Sprague and Miss Harriet Chapman Jones, daughter of Captain H. R. Jones, U. S. A., retired, were married October 11th, at Hill View, the home of the bride's parents, in New Hartford, Conn.

At a recent meeting of the executive committee of the Erie Canal Electric Traction company, it was decided to adopt for use upon canals, including the Erie, the storage-battery motor, subject to the approval in this state of the superintendent of public works. These motors are the invention of the Columbia and Electric Vehicle company of Hartford, Conn., and the Electric Storage Battery company of Philadelphia.

Professor Amos Dolbear of Tufts College, Boston, has made good his statement of a few days ago that he would bring action against Marconi for alleged infringement of a patent. Professor Dolbear has a patent for the "art" of wireless telegraphy which, his lawyer alleges, covers the entire field of telegraphing without wires. Notice to appear on November 6th in the United States Circuit Court has been served on Marconi. It was issued by Commissioner Shields. The complainant is Lyman C. Learned of Massachusetts.

The Electric Boat company has purchased the stock and assets of the Electro Dynamic company of Philadelphia, including its factories at Philadelphia and Newark, with an old and well-established business. At a meeting of the directors of the Electric Boat company Clement A. Griscom, William M. Potts and L. T. Paul were elected directors.

A blockade on the Brooklyn elevated railroad on Myrtle avenue, near Bridge street, Saturday morning, was the indirect cause of the death of two persons and injuring of six others. A motor car had broken down, and as the trains became blocked the passengers left the cars and walked on the footpaths to the nearest station. One car started up, and a boy hanging on the gate struck against seven men who were walking on the footpath and knocked them to the street below. One of the men was killed and a colored woman near by who saw the disaster died of heart disease. M. L. G.

Canadian Intelligence.

Ottawa, Ont., October 21.—The shareholders of the Royal Electric company of Montreal have authorized the directors of that company to increase the capital stock to double its present amount. The present capital is $1,500,000, so that the increase will make it $3,000,000. For the time being, however, only $750,000 new stock will be issued, this being decided upon by the directors at a later meeting. The announcement of this large increase in the capital stock of the Royal Electric company came as something of a surprise to the "street," as it was expected that an increase of only $750,000 would be asked for.

The work on the new power house of the Ottawa Street Railway company is about completed. There are three new sets of water-wheels, the hydraulic machinery being manufactured by the Stilwell-Bierce and Smith-Vaile company of Dayton, Ohio. The new plant will be used at all times except in the case of accident, when the present plant will be used in its stead. The shaft of the new set of water-wheels will be common to all and will be connected directly with the dynamos, which will revolve at the rate of 100 revolutions per minute.

The Cataract Power company has offered to furnish electric power to pump the water supply of the city of Hamilton, Ont., by electricity. The company offered to supply electric power at such a figure that the proposed increase in the water service and a continuous fire pressure could be secured at a less figure than the city is at present paying. If the city makes a contract for 20 years the company will supply the necessary new pumps, motors, buildings, water mains, etc., at the actual cost. It is estimated that the Cataract company's offer would effect a saving to the city of $1,400 a year.

Many of the leading stock brokers of Montreal visited the electric works of the Royal Electric company of Montreal at Chambly recently. The first point of interest was the magnificent concrete dam which extends first across the Chambly River for a distance of 550 feet, then down the river 1,627 feet, and then inshore another 320 feet, thus forming a Z. The dam makes the head race or supply pond, which provides the water to the power house for the generation of the electric power. The power house is a steel structure inclosed in brick. At present there are two exciters and four huge generators in operation, but there is room for four more generators, which will be placed in position as soon as the necessity arises. Each generator has a capacity of 2,500 horse power, making the total quantity at present 10,000 horse power, and the ultimate capacity will be 20,000 horse power. Among the visitors was Mr. W. R. Eckart of San Francisco, the representative of the Blue Lakes and San Francisco Electrical company, which is putting in a plant to supply power from the Blue Lakes in

Nevada to San Francisco, a distance of 150 miles, with a voltage of 60,000 volts, the highest voltage ever attempted. The machinery has been ordered from the Stanley Electric company of Pittsfield, Mass., the associate company of the Royal Electric company, which designed the latter's machinery, and the special object of Mr. Eckart's visit was to inspect this machinery. A. V. W.

PERSONAL.

Morris Franklin Tyler, the new treasurer of the Yale University Corporation, is president of the Southern New England Telephone company. He is a lawyer and prominent man of affairs in New Haven.

The body of John Mason Jackson, late secretary and treasurer of the Western Electric company, has been brought from Honolulu, where he died on July 6, 1898, and was interred, after a brief service at the grave, in Oakwoods Cemetery, Chicago, on October 22d.

The engagement of Miss Cecelia Miles, daughter of General and Mrs. Miles, to Capt. Samuel Reber, United States Army, is announced. Captain Reber is a member of General Miles' staff, and served in the war with Spain as colonel of volunteers. He is interested in electrical investigation and was one of the judges for the department of electricity at the World's Fair.

At the last account Mr. W. J. Johnston, former publisher of the Electrical World, was in Japan in his tour around the world. About the middle of December, after "doing" Japan, Corea and China, Mr. Johnston proposes to go to Manila. From the Philippines, he is to complete the circle of the globe by visits to Java, India, Egypt, Turkey, Greece, Spain, etc., and after attending the Paris Exposition, he expects to be back in New York about June or July, 1900. The total distance traveled will have been about 40,000 miles.

ELECTRIC LIGHTING.

Under an act of Congress the Bureau of Navigation of the Navy Department is inviting sealed proposals until November 2d for the installation of a 125-volt, 300-kilowatt electric-lighting plant at the United States Naval Academy at Annapolis, Md. Prospective bidders desiring information regarding this contract can obtain it upon application to A. C. Crowninshield, Navy Department, Washington, D. C., or to the superintendent of the academy at Annapolis.

A dispatch from Visalia, Cal., states that the Mount Whitney Electric company of that city has perfected arrangements with the Hanford Electric company, whereby power and light for Hanford, Lemoore and all the West Side territory will be furnished by the Visalia station. At present Hanford is supplied with electricity by the Fresno company, but the service is poor, owing to the lack of water supply for generating the current. The Mount Whitney system has a capacity of 10,000 horse power and the water supply is unlimited.

ELECTRIC RAILWAYS.

The Covington, Cincinnati and Erlanger Street Railroad company has been incorporated in Covington, Ky., with a capital stock of $250,000.

The Decatur (Ill.) Traction and Electric company has been incorporated with a capital stock of $250,000. The incorporators are D. S. Shellabarger, W. L. Shellabarger, L. C. Shellabarger.

A novel suit has been brought against the Union Elevated Railroad company of Chicago by Leopold M. Stern, who claims five cents damages for breach of contract. The plaintiff says that while he waited at a loop station one day for a car, two trains passed by without stopping. He demanded the return of his money and it was refused him.

The annual meeting of the stockholders and directors of the Joliet Railroad company was held on October 23d at Joliet, Ill. It was announced at the meeting that the company had acquired all rights for the operation of a line from Lemont to Chicago and that work would soon be commenced on the extension. It was given out also that the Joliet Railroad company would pass into the hands of the American Railway company, which now owns lines in Cincinnati, Philadelphia, Dayton and Springfield, O. The following-named were elected directors for the year: Walter Davis, Henry P. Cox, J. E. Burnham, Edward Winslow, Edward Woodman and George F. Duncan of Portland, Me., and W. B. McKinley of Chicago.

AUTOMOBILES.

The world's record for speed for an automobile, held by Paris, was broken in the same city a few days ago by a representative of an automobile company, who, it is said, averaged 46 1-3 miles an hour during a run of six hours, without a single stop, over ordinary country roads.

It has been stated that Mr. Isaac L. Rice of the Electric Vehicle company that by means of the Siemens and Halske Electric company of America, which his company controls, the Columbia and Electric Vehicle company is in position to furnish during the coming year an output of at least 8,000 automobiles, representing at present prices a gross business of about $20,000,000. The exclusive right to purchase the entire output of the Columbia company is assured, he says, by contract to the Electric Vehicle company, which thus becomes the sole agency for its disposal. The Electric Vehicle company has adopted the policy of organizing transportation companies throughout the country, each vested with the exclusive right to purchase for operation and sale within its territory the product controlled by the Electric Vehicle company. The Illinois Electric Vehicle Transportation company is the authorized licensee company operating in Chicago.

POWER TRANSMISSION.

The Cumberland Falls (Ky.) Power company has been organized, with a capital stock of $500,000 for the purpose of erecting an electric-power plant at a cost of $150,000. The following-named are officers of the company: President, C. W. Banta; treasurer, L. H. Morgan, Louisville, Ky.; secretary, James C. Allin, Louisville.

The Connecticut capitalists who own the Watauga Lighting and Power company and the Johnson City and Carnegie street railway of Johnson City, Tenn., have awarded the contract for building a dam in Watauga River, near Johnson City, and propose operating their plants by means of electricity produced by water power. The cost of improvements is estimated at $25,000.

PUBLICATIONS.

The Joseph Dixon Crucible company of Jersey City has issued a little pamphlet concerning the use of Dixon's Ticonderoga flake graphite for cylinders and valves.

The Electric Appliance company, Chicago, has just issued a circular giving description and prices of its new switch, Eaco. It is promised that the popularity of Eaco tape will give the trade confidence in any article the Appliance company may put on the market under the name of Eaco.

The fire report for the quarter ended October 10th has been issued by the electrical bureau of the National Board of Fire Underwriters. It includes several accounts of electrical fires reported by the various electrical inspection departments of the bureau, the fires noted being selected with a view to illustrating the less common conditions under which electrical troubles occur.

A catalogue devoted to the use of cable and insulated wire was distributed to the delegates and visitors in attendance at the street-railway convention by the Safety Insulated Wire and Cable company of New York city. Illustrations and dimension tables of the different wires and cables for telephone, telegraph, electric-light, street-railway, submarine, power-transmission and police and fire-alarm service are given, besides several valuable testimonials and tables, showing the properties of copper wires.

Not to be outdone by others, the Victor Telephone Manufacturing company of Chicago comes out with a well-printed house organ, the Victor Telephone Journal, the first number being for the month of October. It will be issued "every little while," probably once a month. The first number is very creditable to Mr. William T. Blaine, the editor—an old newspaper man, by the way—and is enriched with fine portraits of the officers of the company and illustrated descriptions of Victor apparatus.

A bulletin is being distributed to the trade by the Western Electric company, which illustrates and dwells upon the merits of a new type Sunbeam 16 candle power street-railway lamp which the company manufactures. The filament of the lamp is in the shape of a loop and is made particularly to withstand the vibration and variation in voltage usually existing in railway service. The lamps are made for use in series on 500, 550 or 600-volt circuits. A catalogue, illustrating all makes of the new type Sunbeam lamps, is about to be issued by the company.

TELEGRAPH.

The Guardian Trust company of Chicago is said to have secured absolute control in the United States of the patents of the Pollak-Virag automatic telegraph system. It is expected that the machines used in its operation will shortly arrive in Chicago, and the first test of their workings in this country will then be made.

TECHNICAL SCHOOLS.

The University of Pennsylvania offers a four-year course in electrical engineering, leading to the degree of bachelor of science in electrical engineering, and a similar course in mechanical engineering. Circulars giving information regarding the courses of instruction offered in these departments have been recently issued by the university.

MISCELLANEOUS.

The French navy is said to be installing a system of wireless telegraphy between the lighthouses along the French coast.

At a recent meeting of the Chicago City Council an ordinance was passed transferring $26,500 from the street-lighting fund for the extension of the fire-alarm and telegraph system, so as to put the wires underground.

A dispatch from Havana says that an attempt will shortly be made to connect Havana and Key West by the Marconi system of wireless telegraphy. It is claimed that if this is successful it will reduce the expense of cabling to New York by more than half.

A paper by H. M. Biebel of the Western Electric company, on "The Development of Constant-current Arc Lighting," will be read at the regular meeting of the Chicago Electrical association, November 3d. The meetings are held in room 1741, Monadnock building, at 8 p. m.

The Navy Department has received the following bids (all the electrical work included) for furnishing the power plant and operating machinery for the dry dock to be constructed at the League Island, Pa., navy yard: Westinghouse Electric and Manufacturing company, Pittsburg, Pa., from $243,415 to $236,290; United company of New York, $223,300; Atlantic, Gulf and Pacific company of New York, $199,500.

The power of the city of Chicago to compel telephone and telegraph companies to put their wires underground in districts where the terms of their franchises permit overhead equipment is to be tested in the Thirty-second ward. Ald. Nelson has introduced in the City Council an order requiring the commissioner of public works to compel the burial of the wires within a year from November 1st, and it is proposed to make a test case of it. The corporation counsel has approved the measure. An important point involved is whether the Western Union Telegraph company, which has no city franchise, but operates under an act of Congress entitling it to the use of highways, can be compelled to remove its poles, and also whether the city has sufficient control over the poles to warrant taxing them, as it has been proposed to do.

TRADE NEWS.

The Hercules Electric Drill company of Denver, Colo., has been incorporated, with a capital stock of $5,000,000, by Samuel Lesem, Celestine Wisebart, Louis Lesem, Edgar P. Long and William K. Burchinell.

The Lea Manufacturing company of Elwood, Ind., manufacturer of the well-known Lea arc lamp and other electrical apparatus, announces that it has appointed the W. R. Garton company, Chicago, as its general western agent.

The Drawbaugh Electrical company of Camden, N. J., has been incorporated with a capital stock of $25,000 to manufacture electrical supplies. The incorporators are: Samuel L. Kent, Clifton Heights, Pa.; Charles A. Gladding, Philadelphia; Elias Mosler, Pensauken, N. J.; Brenton N. Newcomb, Philadelphia.

"Federal salt" is a compound that is being put on the market by the Federal Battery company of New York city, to take the place of sal ammoniac for batteries. With the use of this salt it is claimed that the voltage of almost every battery now using sal ammoniac can be raised and in addition that the life of the cell will be increased 33 per cent. The Federal batteries, made by the same company, are also said to possess many very good points and to have an efficiency above all others.

BUSINESS.

The General Incandescent Arc Light company, 572-578 First avenue, New York, announces that it has absorbed the Wright Discount Meter company, and that all inquiries regarding the Wright system of charging addressed to it, or any of its various offices, will receive prompt and careful attention.

The Illinois Electric company of Chicago has secured the agency for the Peerless transformers, manufactured by the Warren Electric and Specialty company, Warren, Ohio, and has taken an order for 18 of the transformers to be shipped to the Wooster Electric Light company, Wooster, Ohio.

John L. Peterson & Co. of Galesburg, Ill., successors to A. W. Knutson & Co., manufacturers of the Knutson arc-lamp clutch, are placing on the market a one-piece upper and lower carbon holder in which much interest is said to be taken by the arc-light fraternity. This is said to be the only one-piece holder on the market. The firm will be pleased to send further particulars on request.

The H. E. Plass Electric Supply company of New York is manufacturing a line of up-to-date and attractive electrical novelties, including electric scarf-pins, ruby lamps, illuminated roses for wearing and for decorative purposes. Everyone interested in electrical novelties is requested to correspond with the Plass company. The specialties are well adapted for the holiday trade.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 17, 1899.

634,862. Tool for Electricians. James N. Baggett, Bartow, Fla. Application filed July 19, 1898.

The tool has a handle fitted with a cap which forms a lamp-plug socket and is provided with connected wire-tapping devices.

634,871. Switching Apparatus. Alexander T. Brown, Syracuse, N. Y., assignor to Wilbert L. Smith, trustee. Application filed May 11, 1896.

The apparatus comprises fixed terminals each formed with a series of electrically connected branches or arms, additional fixed terminals each formed with a series of electrically connected branches or arms crossing the former branches or arms, circuits connected to the fixed terminals, and terminals normally connected to the circuits and movable between the electrically connected branches or arms of the fixed terminals.

634,903. Electric-motor Frame. Edmund C. Morgan, Chicago, Ill., assignor to the Westinghouse Electric and Manufacturing company, Pittsburg, Pa. Application filed March 24, 1892. Renewed August 31, 1899.

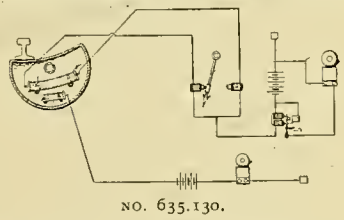
A truck-axle is combined with a motor yieldingly suspended with reference to the axle, a swinging frame mounted on the axle and adapted to guide the motor, and attachments on the motor for the reception of the swinging ends of the swinging frame.

634,911. Thermostat. George F. Richardson, Hartford, Conn. Application filed May 19, 1899.

A bar adapted to expand and contract by heat and cold is connected to a pivoted electrode which vibrates by the expansion and contraction of the bar, and two fixed electrodes are adapted to respectively make contact with the pivoted electrode accordingly as it is vibrated one way or the other

634,912. Mechanism for Electrically Illuminated Devices. John S. Richardson, Samuel Jevons and William A. Gent, Birmingham, England. Application filed September 24, 1898.

Lamps and circuit connections are combined with a double switch controlling the circuits to the lamps, a solenoid and weight, a switch for diverting the current through the solenoid when the core and weight have reached their lowest position, and means for operating the double switch, the means being operated by the rising movement of the solenoid and weight.



NO. 635,130.

634,932. Lightning Arrester for Electric Circuits. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 12, 1899.

The invention consists of the combination with a supply circuit, of a plurality of translating devices connected therewith, each translating device containing a lightning arrester bridging its terminals, and a ground branch for the circuit common to several lightning arresters.

634,933. Antiseptic and Germicide Attachment for Telephones. Albert E. Woolf, New York, N. Y. Application filed March 16, 1899.

An attachment to a telephone is described which consists of a movable cover having applied to its inner side a receptacle for a germicide, and a germicide or antiseptic contained therein, whereby, when the telephone is in use, the receptacle and germicide may be removed from the opening of the mouthpiece, and when not in use the cover may be closed upon the mouthpiece.

634,937. Speed Indicator. Harold W. Buck, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 7, 1899.

The indicator comprises a dynamo-electric generator, means for communicating to the generator a motion which is a function of the motion of a moving body, a source of constant counter-electromotive force, and an indicator in the generating circuit responsive to changes of voltage, but calibrated to indicate varying speeds of the body.

634,940. Combination Push Button and Fire Alarm. William A. Guthrie, Durham, and Joseph B. Underwood, Fayetteville, N. C. Application filed January 21, 1898.

Comprised in the construction of the invention are a base, two spring-contact plates, a plug of fusible metal, a cap for enclosing the operative parts and a push button.

634,965. Electrical Measuring Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed December 31, 1897.

The instrument has a magnetic motor mechanism for giving movement to the indicator away from the zero position, and a magnetic return mechanism opposing the motor mechanism and returning the indicator to the zero or initial position, the motor and return mechanisms being subject to like changes in the strength of the energizing magnet or magnets.

634,979. Electric Motor for Driving Motor Carriages, Winches or Stationary Machinery. Henry W. Headland, London, England. Application filed January 18, 1898.

The field-magnet hub of the motor runs loosely on a spindle, on which is fixed the armature, both rotating in opposite directions. Other features are a bevel wheel on the field-magnet hub, a bevel wheel on the armature spindle, the conicity of the two bevel wheels being toward each other, bevel-wheel gearing engaging therewith arranged between the bevel wheels, and a framing provided with bearings for the spindles and surrounding and containing the whole motor and gearing.

634,994. Automatic Telephone Directory. John B. Neuendorff, San Antonio, Tex. Application filed May 25, 1899.

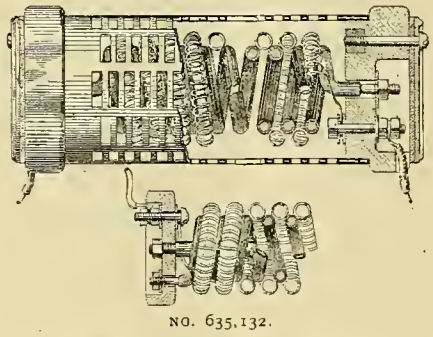
A device is described which comprises a casing, vertically movable plates mounted in the casing and adapted to be withdrawn therefrom, a spring-actuated carrier arranged to be engaged by the plates and adapted to return them within the casing, and a locking device for engaging the carrier.

635,006. Insulated Handle for Electrical Apparatus. John J. Walsh, Yonkers, N. Y. Application filed March 10, 1899.

An insulating hub for the shafts of rheostats and other electrical apparatus is described consisting of two separate parts of insulating material bolted together and keyed to the shaft.

635,007. Telegraph-wire Joint. Thomas D. Wilkinson, Portland, Me. Application filed April 25, 1899.

A telegraph-wire connector consisting of two integral parallel tubes, the diagonal opposite ends of which are closed and having curving or tapering surfaces.



NO. 635,132.

635,008. Telephonic Apparatus. George L. Anders, London, England. Application filed May 12, 1899.

There are combined a fixed transmitter having projecting metallic horns or clips connected to the line, a receiver provided with a metallic rim adapted to engage with the horns or clips, and a ringing key located in the receiver, one terminal of the key being permanently connected to the rim of the receiver, the other terminal being connected through a flexible lead to the transmitter.

635,010. Means for Testing Signaling Circuits. Henry C. Bundy, Watertown, N. Y., assignor to the Gamewell Fire Alarm Telegraph company, New York, N. Y. Application filed March 16, 1899.

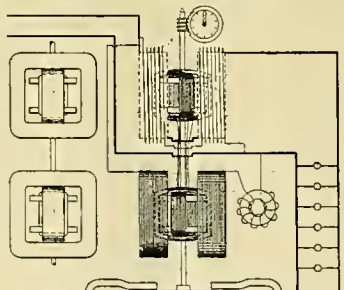
Means for testing a section of a normally closed circuit are described, the section having a break device and bell therein, and comprising a resistance arranged in shunt to the break device and bell, and sufficient to prevent a short-circuit thereof.

635,058. Electric Incandescent Lamp. William J. Phelps, Elmwood, Ill. Application filed May 23, 1898.

The lamp comprises an exhausted globe, a plurality of incandescing filaments or sections, a sleeve having an annular ridge adapted to engage the holding device of a socket and constituting one electrical terminal of the lamp, and means operated by the rotation of the lamp for affecting the flow of current to the filaments or to the section of one filament.

635,080. System of Stopping Steam Engines. Arthur J. Purinton, Waterbury, and John R. Reynolds, Hartford, Conn., assignors to the Monarch Manufacturing company, Waterbury, Conn. Application filed July 20, 1899.

An electromagnetic stop is connected with a throttle valve in the steam main, and an electromagnetic vacuum breaker is connected with the condenser. When the circuit is closed the vacuum breaker is free and allowed to operate and open a passage from the outer air to the condenser chamber.



NO. 635,159.

635,130. Switch-signaling Device. Charles Fearon and William E. Bradley, Philadelphia, Pa. Application filed April 9, 1898.

The device has a casing with a concave upper face and oscillatable in proper bearings, in combination with one or more line terminals situated in and movable with the casing, a gravity switch suspended in the casing and adapted to make and break contact with the terminal or terminals as the casing oscillates from one position to the other, and a switch rail situated immediately over and in operative position with respect to the face of the casing and so as to turn the casing as it is moved and thus shift the terminals with reference to the gravity switch. (See cut.)

635,131. Electric Heater. Edward E. Gold, New York, N. Y. Application filed January 31, 1898.

A heater is described which comprises a minor helix of resilient resistant wire coiled into a compound helix, combined with a support consisting of a helical insulating rod extended parallel with the minor helix and exterior to the minor convolutions thereof.

635,132. Electric Heater. Edward E. Gold, New York, N. Y. Original application filed January 31, 1898. Divided and this application filed May 18, 1898.

This heater comprises a skeleton or open-work support in the general form of a tube, and a helix of resistant wire wound helically around the support, whereby air may circulate between the meshes of the helix and through the openings into and out of the interior of the support, and into contact with all portions of the heated resistant wire. (See cut.)

635,133. Electric Heater. Edward E. Gold, New York, N. Y. Original application filed January 31, 1898. Divided and this application filed January 9, 1899.

In the heater are combined an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, and a support therefor consisting solely of a stiff rod or rods extended parallel with and exterior to the helix and making tangential contact with the convolutions thereof at two points separated less than the diameter of the resistant helix, so as to permit the latter to enter only partly between the supporting rods.

635,139. Regulating Electric Motors. Martin T. A. Kubierschky, Berlin, Germany. Application filed August 4, 1899.

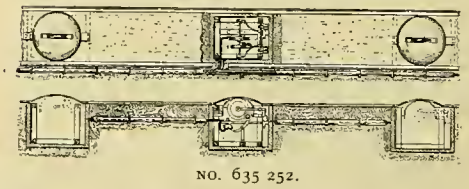
A circuit of substantially constant potential is combined with two sources of current of inversely variable electromotive force, means for combining the electromotive forces, and means for impressing the resultant electromotive force on the circuit.

635,140. Electric Gas Lighter. Georg O. Lentschat, Cologne, Germany, assignor to Kölner Wassermesser Werk Gesellschaft mit Beschränkter Haftung, Cologne, Germany. Application filed April 9, 1898.

Features of the lighter are a plug or part closing the gas opening to the burner, a disk pivotally mounted upon the plug adapted to control the supply of gas to the burner, the plug and disk being provided with a set or series of bored holes, the disk also having a toothed or ratchet edge, a star-shaped armature pivoted upon the perforated plug, the armature being provided with a pawl engaging with the toothed edge of the perforated disk, electromagnets associated with the armature adapted to effect its rotation upon the pivot, and a spring acting upon the armature in a direction opposed to the action of the electromagnets.

635,159. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed September 10, 1897.

An induction wattmeter for alternating currents is described which comprises a current coil, a potential coil of phase displaced from that of the current coil, and two armatures upon the same shaft coacting to impart torque thereto and respectively within the fields of the current and potential coils. (See cut.)



NO. 635 252.

635,172. Push Button. Adolph C. Meier, Sedalia, Mo. Application filed July 7, 1899.

The push button has a disk of non-conducting material, a non-rotatable screw-eye with its head or eye secured to the disk, an inclosing casing, a button, and a spring contact between the button and screw-eye.

635,195. Telephone-call Register. John Shannon, Buffalo, N. Y. Application filed February 23, 1899.

Combined with a registering mechanism having an actuating shaft is a trip-wheel splined on the actuating shaft and capable of sliding laterally thereon, the wheel having teeth adapted to be brought into the path of the ringing-crank of a telephone, for intermittently operating the trip-wheel and the registering mechanism by the turning of the crank.

635,252. Electric Railway. Lyman D. Howard, Philadelphia, Pa. Application filed September 30, 1891.

In the system described are combined a roadway, a series of isolated pits along the roadway, each pit having a rising-and-falling counterbalanced wheel adapted to contact with a contact on the vehicle, a rising-and-falling contact carried by the wheel, a vertically yielding contact mounted in the pit and adapted to engage with that connected with the wheel, a stationary contact, a hood or casing for the stationary contact, a main conductor extending along the roadway, and a series of branch conductors respectively connecting the main conductor with the stationary contacts. (See cut.)

635,262. Trolley Wheel. John H. Lester and George H. Lester, New York, N. Y. Application filed January 31, 1899.

The wheel comprises a rim and body of soft electrical conducting metal provided with a central cylindrical socket extended inwardly from one side of the body a distance sufficient to leave a portion of the body between the base of the socket and the other wall of the body.

635,276. Magneto-electric Machine. Elisha B. Cutten, Butte, Mont., assignor to Josiah Mahon, New York, N. Y. Application filed August 19, 1899.

There are in combination with the normal armature circuit and a shunt circuit, a switch for opening and closing the latter, the switch consisting of a rotating part or disk in the shunt circuit, the disk having interruptions in its conducting contact surface, and an interrupter making contact with the disk and movable to vary the point of contact relatively to the armature poles.

635,280. Combined Pump and Motor. Niels A. Christensen, Milwaukee, Wis. Application filed December 30, 1896.

A frame with an oil chamber is combined with a shaft provided with a crank or eccentric inclosed in the chamber, a cylinder formed with or attached to the frame and opening at one end into the chamber, a piston fitted to work in the cylinder and connected with the crank or eccentric, a motor base attached to the frame and forming a cover for the oil chamber, an armature supported upon the base and connected by gears with the crank-shaft, and a gear case attached to the frame and motor base and forming therewith an inclosure for the gears and a receptacle for holding oil, the frame gear case and motor base completely inclosing and protecting the driving connection of the pump and the crank-shaft terminating within the gear-case, whereby a stuffing box therefor is dispensed with.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, NOVEMBER 4, 1899. No. 19

Niagara Power Company's Great Extension.

Bids for the construction of a new wheel-pit have been received by the Niagara Falls Power company, and this means that another big power house will also be built. The site of this proposed extensive new work on the part of the big power company at the falls is well portrayed in Fig. 1. The view is one showing the inlet canal, and at the right are to be seen the inlets, or a portion of them, which will feed the new penstocks. To the left will be seen the transformer station in its enlarged form, the section on the near side of the gable having been built during the past summer. Running off in the distance is the Niagara-Buffalo transmission line. The buildings in the center are the carborundum, graphite and other factories, while to the right, where the earth is thrown up, is the site of the new flax-fiber plant.

No picture was ever taken that gives a better idea of the wheel-pit and its installation than that shown in Fig. 2. The view was taken immediately beneath the floor of the dynamo room, and the turbine shafts and penstocks are to be seen.

One of the most interesting pieces of brickwork in the country is that in the lining of the big wheel-pit. This pit is over 400 feet long, 179 feet deep and has a width of 20 feet. The object in lining the pit was to prevent the walls breaking away as a result of disintegration, and to build the lining took nearly 2,500,000 brick. At the time of the construction of the original section of the wheel-pit it was not lined, but when the extension of the pit was built, the new part was immediately lined, and as soon as the new section was finished men were set to work lining the original section. In this first part of the pit nearly 1,000,000 brick were used, and in the new section there have been placed about 1,250,000 brick. The brick wall below the turbine deck has a thickness of 20 inches, and from this point, part way up the pit, there is a 16-inch wall, after which a 12-inch wall cuts in and runs to near the top. The "header" and "stretcher" method of laying the brick was employed in the work, and the men worked at night, as the electric crane used in lowering machinery into the pit was in use during the daytime. The contractor for the work was A. C. Douglass of Niagara Falls.

The fact that the tunnel of the Niagara Falls Power company was built for 120,000 horse power adds interest to the view of Fig. 3, which shows the portal of the tunnel as it is to-day, eight turbines having been installed. It will be observed that the water pours out of it with tremendous force. In Fig. 4 the effect of this stream on the current of the lower river is well illustrated. The stream from the tunnel strikes the river, plunging and dancing, and for all that back of the main body of the stream there is the awful force of all the water that falls over the precipice every minute, the current of the stream is diverted—on the surface, at least—and the outpouring water from the tunnel strikes clear across the river to the Canadian shore. The white portion of the river to the left of the picture is foam that has come down the river from the falls. It will be noticed that the stream from the tunnel changes the course of this foam over to the Canadian side. In this fact is demonstrated that the grade of the tunnel was well calculated, in order that the water that flows from the turbines might be discharged through the tail race with efficiency. It is not an indication that a great amount of water is being used, but is ample evidence that the Niagara Falls Power company built well. The success of that company in developing the power of Niagara is an example to other power companies contemplating the development of any power that it pays to build all work most substantially. In all that the Niagara Falls Power company has accomplished for the electrical and engineering fields nothing has stood out more prominently than the fact that it pays to plan with the greatest of care, and then build with equal care.

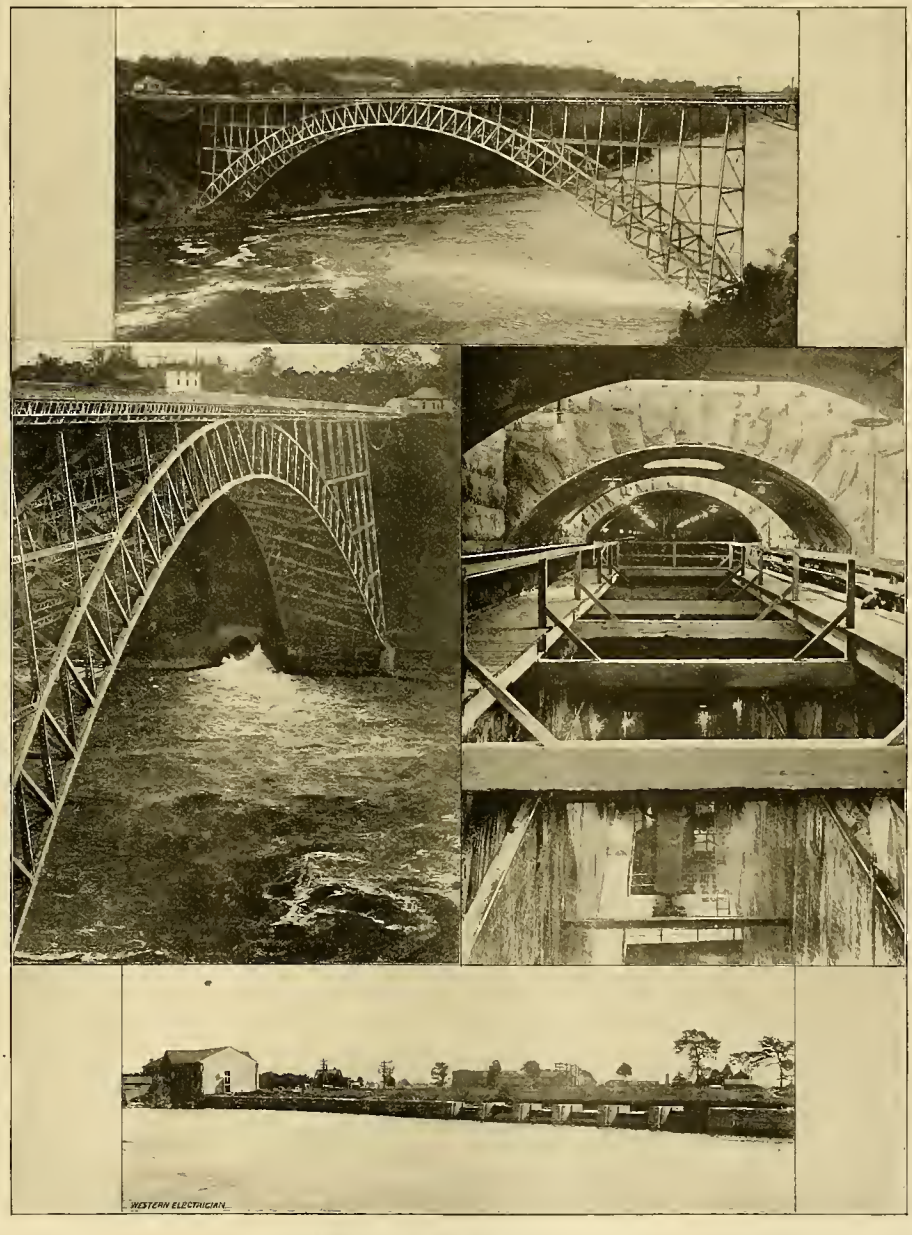


Fig. 3. Portal of the Tunnel.

Fig. 4. Effect of Tunnel Stream on Current of the River.

Fig. 1. Site of New Extension.

NIAGARA FALLS POWER COMPANY.

Fig. 2. Wheel Pit.

The incorporation of the Columbus, Buckeye Lake and Newark Traction company, with its principal office at Columbus, O., was authorized recently. The company will operate an electric railway in the counties of Franklin and Licking. The tracks will be laid from Columbus to Newark with a branch road to Buckeye Lake. Among the incorporators of the company, which is capitalized at $100,000, are M. Spellacy, A. J. Warner and W. A. Carlisle.

Boston Elevated Railway.

General William A. Bancroft, who has been advanced from the position of vice-president, which he held in conjunction with his office of general manager, to the presidency of the Boston Elevated Railway company, recently addressed the New England Railroad Club on the subject of street railways, and gave some interesting particulars regarding the great system of which he is the directing head. In part he said:

"The surface system now operates cars in 12 different municipalities, with Boston as the center, and Chelsea, Everett, Malden, Medford, Somerville, Arlington, Belmont, Cambridge, Watertown, Newton and Brookline within the radial territory.

"The plans approved by the state railroad commissioners for the elevated system now under construction provide for only a few stations, upon the understanding that if rapid transit is to be attained stops must be infrequent. Surface cars will continue to run and will furnish accommodation for short-distance patronage. Transfers at junction points to elevated lines will facilitate matters also.

"The elevated system's trains will utilize the subway in making their run through the heart of the city, special provision being made for them in the great underground structure. The visitor to Boston, therefore, who does not go outside of what is generally known as the business district will not see any of the elevated tracks. The only line strictly 'downtown' will be the one known as the Atlantic avenue branch, running from Washington street, via Motte street, Harrison avenue, Beach street, Atlantic avenue, Commercial street and Causeway street. This will be a connecting link between the northern and southern union stations."

In view of General Bancroft's statements, it is worth noting that steady progress is made with the work of construction. Under the enactments that authorized the building thereof, the elevated road must be completed about 21 months hence. Seven miles of track are planned. The bases which will support the columns designed to bear up the overhead structure are all set in place, except for a short section of the Atlantic avenue branch. The piers, columns and superstructure have been completed on the new Charlestown bridge, and across City Square, Charlestown district; also out to Dover street, on Washington street, in the direction of Roxbury, where a terminal is to be located, with transfer arrangements, at Dudley street. The Charlestown terminal will be at Sullivan Square, and the Cambridge terminal for the projected line across the fine new bridge from Boston to Cambridgeport will be in Harvard Square, near the colleges.

Officers of the Elevated Railway company have visited both the Westinghouse and General Electric plants and have seen experimental trains operated by them, but most of the contracts for equipment are still in abeyance. It is stated, however, that 300 new cars will soon be made for the road, the Bradley Car Works at Worcester and the Wason Car Manufacturing company of Springfield getting the contracts therefor.

The office of chairman of the board of directors

has been created for ex-President Gaston, who will remain in close advisory relations with the management.

Berlin Automobile Exhibition.

A brief article descriptive of the recent international exposition of automobiles in Berlin was given in the Western Electrician a month ago. Further details are now at hand in the shape of a report from Mr. Frank H. Mason, the United States consul-general in the German capital. The following particulars are taken from Mr. Mason's report:

The exposition premises included two sections—the Exercier-Haus, with 2,700 square meters (29,106 square feet) of floor surface, where the carriages, materials and fixtures on exhibition were displayed, and a large parade ground or barrack yard directly opposite, where, under a long tent, were kept the various motor carriages that were in daily use for display and hire during the exhibition. It was part of the programme of the occasion that any exhibitor of a motor carriage might place one or more of the same class in service under charge of a sub-committee, to be run for exhibition about the enclosed grounds or let for hire at fixed rates within prescribed hours of each day to all comers, but under charge of a competent driver furnished by the exhibitor. These carriages were liberally patronized by the public, and on pleasant days formed an interesting feature in the parks and city streets, where they were permitted to run at any speed not exceeding 12 miles an hour, a rate which has been frequently exceeded, but leniently permitted by the police.

The exhibitors numbered 120 firms and companies, of whom 81 were German, four Belgian, 12 French and two from Switzerland. Not a single American or English maker was represented in his own name, although there were tires, driving chains and other machine parts of English origin exhibited under the names of German agents; and three of the most noticeable and admired electric carriages on exhibition were from the works of the Pope Manufacturing company of Hartford, and exhibited by the Motorfahrzeug und Motoren-Fabrik of Marienfelde, a suburb of Berlin, that concern having acquired certain patents of the American company.

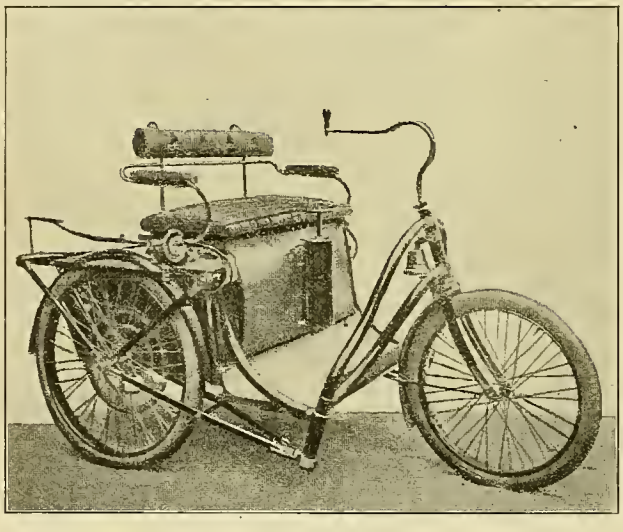


Fig. 1. "Electra" Tricycle.

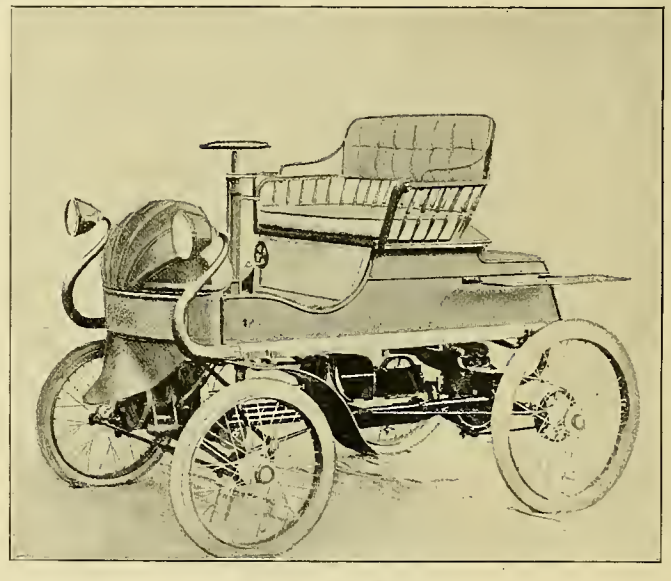


Fig 2. Pieper Double-motor Carriage.

BERLIN AUTOMOBILE EXHIBITION.

The exhibition included 40 different models and types of motor carriages for one passenger or more; 13 exhibitors showed motor wagons for freight; 26 numbers covered exhibits of motor cycles and trail carts belonging thereto; six firms exhibited motors and parts of motors; two showed only springs and wheels for motor carriages; 51 firms displayed various miscellaneous parts, fixtures and materials for motor carriages not included in the preceding classes, and five exhibitors showed the literature, drawings, maps and models which the new science of automobilism has thus far developed.

German carriages are for the most part heavy and somewhat gaudy and crude in upholstery and decoration; they lack the lightness, grace of form and quiet, good taste of the American and some of the best French machines, but on the whole they are substantial, speedy and show many original and promising features.

The exhibition showed about the usual proportions of carriages propelled by electric and some form of hydrocarbon motor—oil, benzine or gasoline. Large sales have been made, some of the different types having been sold as many as 20 times for future delivery; and it is noticed that for town or city use the electrical carriages have the preference among purchasers, while for country districts and freight and delivery wagons the benzine and gasoline motors have the call. This is the natural result of considerations which apply equally in all countries.

Until the electric current can be far more widely and generally supplied than at present, the working radius of the electric carriage must be restricted to the immediate neighborhood of cities and towns, and for long journeys or use in remote country districts the hydrocarbon motor must retain its original supremacy. It is the struggle to overcome or to measurably neutralize these restrictions which now principally engages inventors, and the exposition brought out two original and highly interesting devices, which would seem to deserve a separate description. The problem on hand is to produce an electric carriage which shall be as nearly as possible self-sustaining and independent of recharging from a fixed supply.

The first of these novelties is the "Electra" (Fig. 1), a two-seated tricycle exhibited by A. Krüger of No. 8 Spittel-Markt, Berlin. The frame is of steel tubes, the front guide wheel is moved by a handle within reach of the driver, the rear axle is discarded and the driving wheels hung independently on each side. This gives full space beneath the seat for carrying the motor and a battery, which supplies a current of 2.5 volts per cell employed. The original feature of this machine, aside from its very clever condensed construction, is covered by a German patent, under the title "Transportable Electricity," and is concisely as follows:

A galvanic battery of about two feet in length and 18 inches in breadth and depth is arranged in cells with changeable electrodes, which can be inserted or removed at will. The negative electrodes are ordinary zinc plates; the positive are similarly plates of superoxide of lead, impregnated with an acid salt which is readily dissolved by water. These electrodes being in position, water is poured in, the acid salt is dissolved, the requisite elements of galvanic action are thus completed, and a current is immediately developed, which, being turned into the motor, starts the machine.

When the positive plates are exhausted by consumption of the acid, they can be removed, the spent solution discharged, fresh plates inserted, water again poured in, and the current restored. The vehicle, with its cells filled and carrying fresh electrodes for a run of 60 kilometers (about 40 miles) weighs only 180 kilograms (378 pounds), and its inventor claims for it a radius of 100 kilometers (62.1376 miles) with plates that can readily be carried in its present space.

The bed of the vehicle is so constructed that the battery and motor, with the supply of extra plates, rest on a special set of springs and do not communicate any oscillatory motion to the seat. The motor drives the carriage forward or backward at will, and is managed by a single crank set vertically in front of the center of the seat. This invention was an object of special interest during the exposition; but when tested and explained before the committee of award an accident happened by which the positive electrodes, being overcharged with acid, developed an excess of current, which became, for the moment, difficult to control, so that the machine made an unfortunate impression at a critical moment and received only a bronze medal. The price fixed to this vehicle was $1,014. While unquestionably ingenious and original in many of its features, it may be fairly doubted whether this or any other vehicle depending for its current supply upon a galvanic battery will meet the requirements of the future.

The second novelty, which may fairly be said to have formed the central feature of the exposition, is a combined electric and benzine motor carriage (Fig. 2) from the works of the Pieper company, at Liege, Belgium. In this the problem of making an electric carriage self-sustaining and independent of charging from an outside source has been apparently mastered, although the device as a whole is of recent invention and will doubtless undergo important future improvement. It is called the Pieper double-motor carriage, and, so far as the circulars show, is not patented. This carriage may be described as follows:

The wheels and tubular frame are of the ordinary type, except that the front and rear axles are connected by two strong, rigid steel braces on which rest the electric motor, accumulator and the device for regulating the speed. A benzine motor rests on springs over the front axle and turns the main shaft, which extends backward through the electric motor and connects by mitered gearing with the rear axle that connects the driving wheels. There is thus a benzine and an electrical motor geared to the same driving shaft, and the essential feature of this combination is that both can be worked at the same time or either thrown out and the other left in action, at the will of the driver.

The accumulator can be charged in the usual manner by current from an ordinary lighting-power plant, and when used in cities, the vehicle would be used as an electric carriage, with all the advantages of that system. But on a long journey or remote from outside electrical supply, the benzine motor is not only sufficient to propel the carriage, but, by running the motor as a dynamo, recharges the accumulator.

In the carriage on exhibition the electric motor is of 2½ horse power; the accumulator weighs 125 pounds, and the benzine motor develops three to 3½ horse power ; so that when both are in action in climbing a steep hill or traversing a heavy road, the driver has six horse power at command, which is ample for all contingencies. On level, easy road or whenever the load falls below the maximum power exerted by the benzine motor, the electric motor changes automatically to a dynamo and the surplus force is converted into current. In running down hill or in stopping the carriage the momentum of the vehicle is received by the electric motor acting as a brake and stored as electricity in the accumulator, which is thus, in an ordinary journey, kept constantly charged or, if exhausted, can readily be recharged by running the generator with the motor when the carriage is at rest. An American ampere-meter, set in front of the driver as in the Columbia carriages, indicates the state of the accumulator, and the change of the electrical machine from motor to generator and conversely is automatic, without any touch or attention from the driver.

Thus constructed, this carriage shows high speed, easy control, great elasticity and other essential qualities which are aimed at in motor-carriage construction. Its working parts are all hermetically sheathed, and, notwithstanding its two motors, it is lighter, both in fact and appearance, than most electric carriages. None of its machinery is carried beneath the seat; all is borne upon the running gear below, and the weight of the spirit motor is far more than compensated by the comparative lightness and small size of its accumulator. That it is a perfect, or anywhere near a perfect machine, no one, probably not even its inventor, would claim. But it apparently marks a definite step in the direction which future progress will be likely to take, and is therefore entitled to the interest which it has excited and the gold medal which it has won in the present exhibition. It is sold at retail in the form of an open, double-seated wagon, known in America as a "runabout," for $1,190; but so great is the demand that no delivery can be guaranteed under less than six months.

A charter has been issued to the Southern Heat, Light and Power company of Pittsburg. The capital stock of the company is $1,000, and among its directors are J. W. Smith, W. J. Horgan and R. W. Gobbs.

Electrical Library for Annapolis.

The library of the Naval Academy at Annapolis is to be enriched by the presentation of a collection of books on electricity and cognate subjects which far surpasses any other similar collection in this country, says the Washington correspondent of the New York Tribune. The givers are three residents of New York city who were graduated from the academy and who left the navy and became prominent in civil life. They are Park Benjamin, class of '67; Robert M. Thompson, class of '68, and Edward J. Berwind, class of '69. According to the letter which Secretary Long has received from them, the gift is tendered in recognition of their indebtedness to the institution which educated them and as a memorial of their classes. The collection comprises 1,400 books, many of the fifteenth, sixteenth, seventeenth and eighteenth centuries, and includes about every original treatise relating to the subject of electrical science ever published. Fifteen years have been partially devoted to completing the collection, and its value is known throughout the world. A large percentage of the volumes represents works that are unique, and as it would be impossible to replace them in case of loss, it will be the effort of the Navy Department to have a warship take the books, which fill fifteen large packing cases, from New York to Annapolis, in order to avoid the risks of transportation by rail.

While the sentiment that has inspired the presentation of this library to the Naval Academy is admired by naval officers in Washington and is gratifying to them, there is much disappointment that so priceless a collection could not have found its way into the new Congressional Library, where the scientific men who congregate in Washington could have had access to its treasures. The Naval Academy buildings are at present in a state of uncertainty, being replaced by new structures as fast as the old are demolished, and it may be necessary to keep the library in its packing cases for several years to obviate all chances of injury, loss or destruction. In the splendid National Library building, on Capitol Hill, its safety would be assured and its value notably enhanced.

Milwaukee Railway Company Makes an Offer.

For some time there has been an agitation in Milwaukee between the city and the Milwaukee Electric Street Railway and Lighting company in regard to four-cent fares. The Common Council recently passed an ordinance compelling the railway company to give a four-cent fare, and the company carried the case to the courts, where it was decided that the financial condition of the company was such at the time that it was unreasonable to ask it to carry passengers for four cents. The city, however, has the right, as soon as the company's books show that it would not be an unreasonable burden on it, to enforce the four-cent ordinance. The company now makes the claim that it is secure, and that it will be able to maintain the five-cent fare, but in order to stop the agitation it has presented to the council a proposition to sell commutation tickets at 25 for $1, beginning with the year 1918, and in return it wants all of its present franchises extended for 10 years, and new franchises, the effect of which, it is said, will be to exclude competition in the street-railway business in that city. The proposition of the company in substance is that it shall make a gradual reduction of the fare, granting an extra ride for $1 at the end of each six-year period until 1918, when it will sell 25 tickets for $1. The cash fare at all times, and until the expiration of the franchises, which, if the extensions be granted, will not be until 1924, is to be five cents.

La Bella Power Plant in the Cripple Creek District.

In Goldfield, Colo., is the power plant of the La Bella Mill, Water and Power company, which supplies electric light, electric power, compressed air and water to the mines, mills, samplers, towns and railroads among the mountains of the Cripple Creek gold-mining district. The installation gives evidence of careful engineering and has several features of instructive interest. It was put into operation last August. The ceremony of opening the plant included the starting of the engines from the main office of the company in Denver by an electric starting device. A young lady in Denver closed a key and the machinery in the plant at Goldfield, 100 miles distant, was set in motion. Mr. L. L. Summers of Chicago, the consulting engineer for the company, designed the plant and gave his direct supervision to the work of construction.

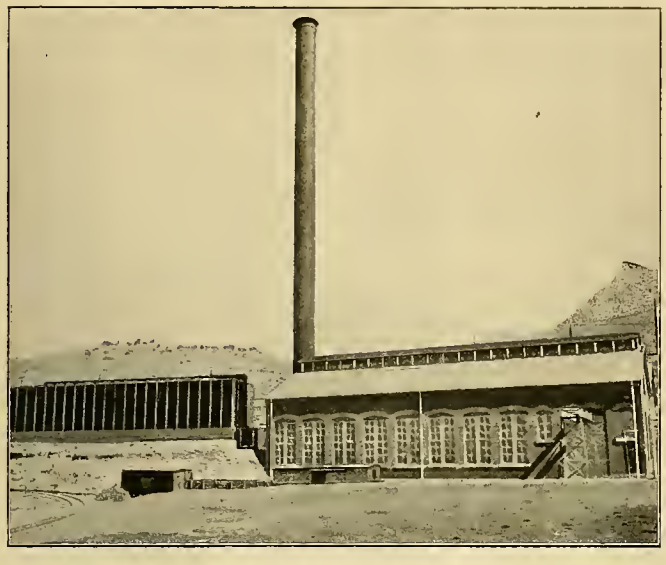


Fig. 1. Power House at Goldfield.

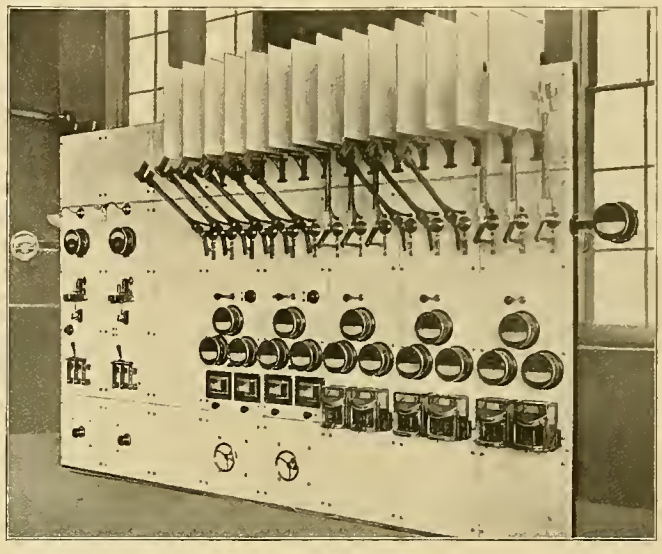


Fig. 7. Switchboard.

LA BELLA POWER PLANT IN THE CRIPPLE CREEK DISTRICT.

It is interesting to note that the power house, shown in Fig. 1 and in plan and cross-section in Figs. 2 and 3, is the first steel building to be erected in the Cripple Creek district. The building covers a space of about 10,000 square feet and extends to a height of 50 feet above the ground. It nestles under the slopes of the high Bull cliffs, but is yet a conspicuous object. The stack is of steel and self-supporting. It is 210 feet high and 12 feet in diameter. Particularly massive foundations give to the chimney strength to resist the high winds prevalent in the altitude in which the plant is placed.

In the boiler room (Fig. 4) are six large boilers of the Babcock & Wilcox type, arranged in three batteries. These boilers are capable of supplying the engines with steam for 3,000 horse power, under normal conditions, and should the service require, they can deliver, readily, steam for 4,500 horse power. They are mounted on elevated steel beams, and a space is thus left underneath all the boilers. The smoke and hot gases are carried downward into s basement space, and thus taken to the stack. The space above the boilers is in this way left clear, and nothing is visible in the boiler room to indicate the presence of a flue. The heat and the obstruction of the large flue is thus done away with in the boiler room. The space above the boilers is left for the steam pipes and valves, and these are readily accessible. A further use is made of the basement under the boilers in the handling of ashes, which are dropped into the basement to an ash conveyor and are carried directly to the cars on the track on the outside of the building. The coal for the plant is likewise handled automatically. It is dumped from cars on an elevated track directly into the steel coal bins. These bins are inverted pyramids supported from the roof, the coal being dumped through the roof into the bins. From the bins the coal falls into a weighing device (Fig. 5), which in turn drops the coal to the automatic stokers. All the feeding of the coal is therefore accomplished by gravity. The automatic stokers are of the Babcock & Wilcox type, having an endless-chain grate. One attendant takes care of the six large boilers, even when the plant is carrying the heaviest load.

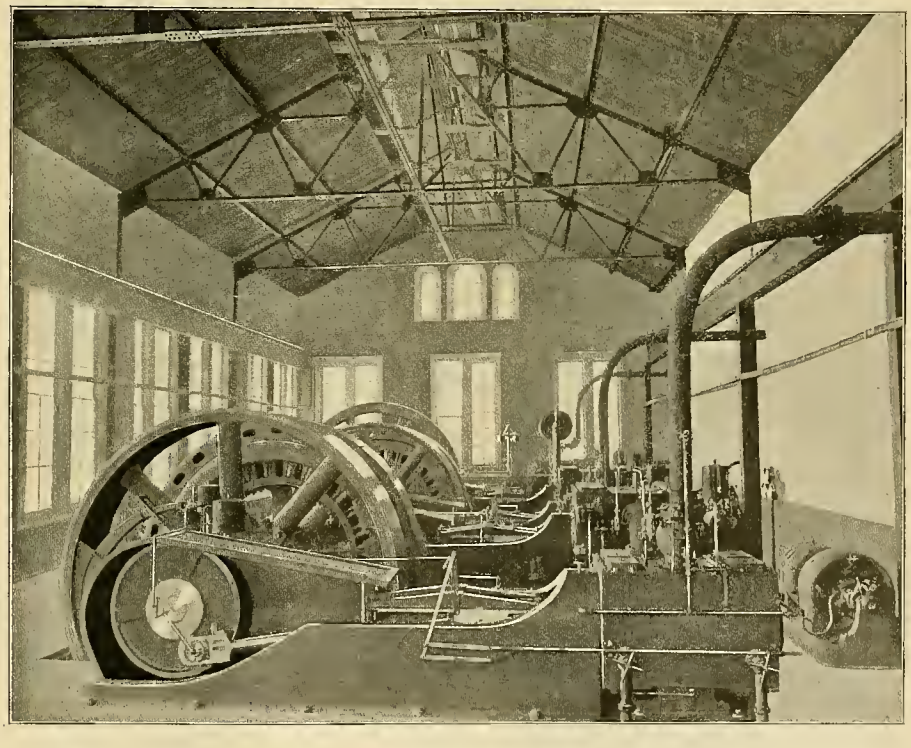


FIG. 6. LA BELLA POWER PLANT IN THE CRIPPLE CREEK DISTRICT.—ENGINES AND GENERATORS.

Next to the boiler room is the pump room, and in addition to the pumps for supplying the plant's requirements, provision has been made for furnishing water to the railroads, mines, mills and other consumers. Underneath the pump room is a deep basement in which is located the econo-

mizer. Adjoining the economizer room is a well-appointed bath and toilet room for the use of employes.

Extending the full length of the building and adjoining both the boiler room and the pump room is the engine room. This room, a view of which is given in Fig. 6, is 110 feet long and 45 feet wide, and contains a large air compressor and three engines direct-connected to generators The combined engine capacity is 3,000 horse power. Over the entire engine room runs a traveling crane, capable of lifting any piece of machinery in the plant. By a novel design this crane is made to extend out of the building and overhang the railroad track and wagon road, so that any piece of machinery is

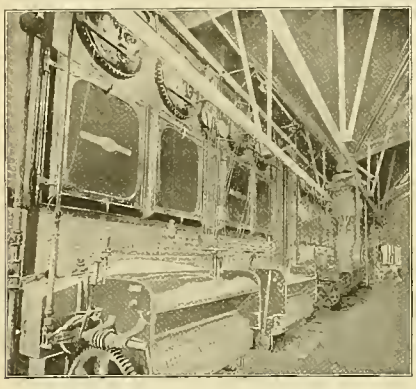


FIG. 4. LA BELLA POWER PLANT IN THE CRIPPLE CREEK DISTRICT.—BOILER ROOM.

readily transferred to any portion of the engine room.

One of the conspicuous features of the engine room is the large air compressor. This is of the Ingersoll-Sergeant make, and is driven by an Allis-Corliss engine. The compressing cylinders and the steam cylinders are both compound, and the steam cylinders are condensing. The high-pressure air cylinder has a diameter of 22 inches, while the low-pressure cylinder has a diameter of 40 inches, both having a stroke of 48 inches. The capacity of the compressor is about 5,000 feet of free air a minute. This compressor supplies air to a large number of producing mines. In one direction a pipe line to the Victor mine extends a mile, while a mile in the opposite direction is the Granite mine, also supplied through a pipe line. There are also pipe lines to the Golden Cycle, Gold Knob and other properties.

The electric power generated will be used to operate the Florence and Cripple Creek railroad

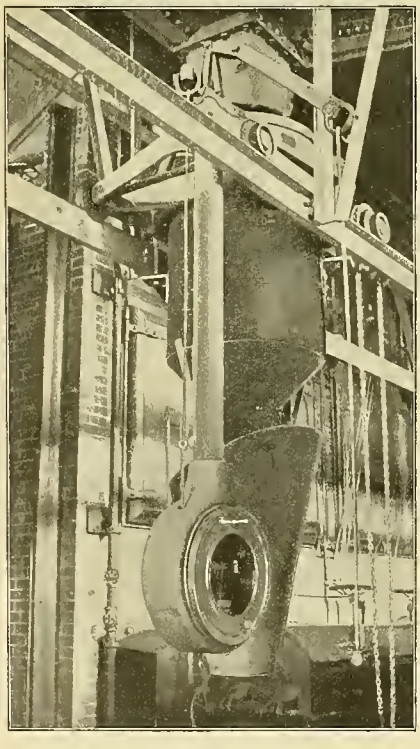


FIG. 5 LA BELLA POWER PLANT IN THE CRIPPLE CREEK DISTRICT.—TRAVELING WEIGHING COAL HOPPER.

from Alta Vista to Cripple Creek, and the Golden Circle railroad from Victor to Cripple Creek via Vista Grande. The surplus power will be used to operate the hoists, pumps, compressors, crushers, etc., in mines, mills, samplers, etc., throughout the district. The engines are of the horizontal type and are compound condensing. The normal capacity of each engine is 750 horse power; the ultimate capacity is 1,100 horse power each. The engines were built by the McIntosh-Seymour company of Auburn, N. Y. The main shaft is 16 inches in diameter. The arrangement is such that part of the engine can be operated while the other part is being cleaned or repaired; that is, the engine is practically a double unit, which may be subdivided. The cylinders are 18 inches in diameter for the high-pressure and 40 inches in diameter for the low-pressure.

The generators were built by the General Electric company. They are revolving-field, three-phase, 750-kilowatt alternators, having an electromotive force of 6,600 volts and 3,600 alternations a minute. At this potential current is furnished customers, who are advised to install transformers providing for secondary circuits at 440 volts. Exciters are driven by independent engines or motors.

An automatic oiling system is installed. When an engine is started the oil is automatically turned on and immediately flows to all parts of the engine requiring lubrication. All oil is caught in receptacles and automatically returned through filters to the supply tanks, to be used over again.

It is said that the guarantees of economy made on these engines and generators were the highest ever made.

Steam piping is so arranged that any pipe can be removed for repairs, or any part shut off for inspection, without disturbing the operation of the plant. The engines are located within 10 feet of the boilers, and the piping required is therefore very short, so the losses of heat are reduced to a minimum. The exhaust piping is likewise very short, offering very slight resistance to the outlet from the engines to the condenser. The condenser is of the elevated-siphon type, and has the peculiarity of separating the air from the water and pumping each separately.

For the purpose of cooling the condensing water there is erected the large cooling tower shown in Fig. 1. This cooling tower is 110 feet long, 20 feet wide and 20 feet high, and is mounted on an elevated piece of ground near the building. Owing to its elevated position, the top of the cooling tower is about 40 feet above the engine-room floor. Water is pumped to the top of this tower and allowed to fall by gravity, and in this way it loses heat by contact with the air. This cooling tower enables the use of condensing engines 10,000 feet above sea level, where water is scarce.

Fig. 7 shows the switchboard. This is of white Italian marble, with panels for generators, exciters and feeders. Each exciter panel is provided with an ammeter, circuit-breaker and main switch, while the voltmeter, mounted on a swinging bracket, can be connected to any exciter by means of a plug switch. The generator panels are provided with main switches, capable of opening the circuits under full pressure, ammeters showing the current in each circuit, indicating wattmeters showing the power furnished from the generator, and a voltmeter switch permitting the voltage of each phase to be determined. There are three feeder circuits, and these are provided with main switches, ammeters to show the current in each wire, and recording wattmeters, to register the total amount of power supplied. All instruments are connected to the board through transformers, so that only low-tension circuits are connected to the instruments.

The plant is thoroughly modern in design and is considered fireproof. The principal owners are the men in control of the Florence and Cripple

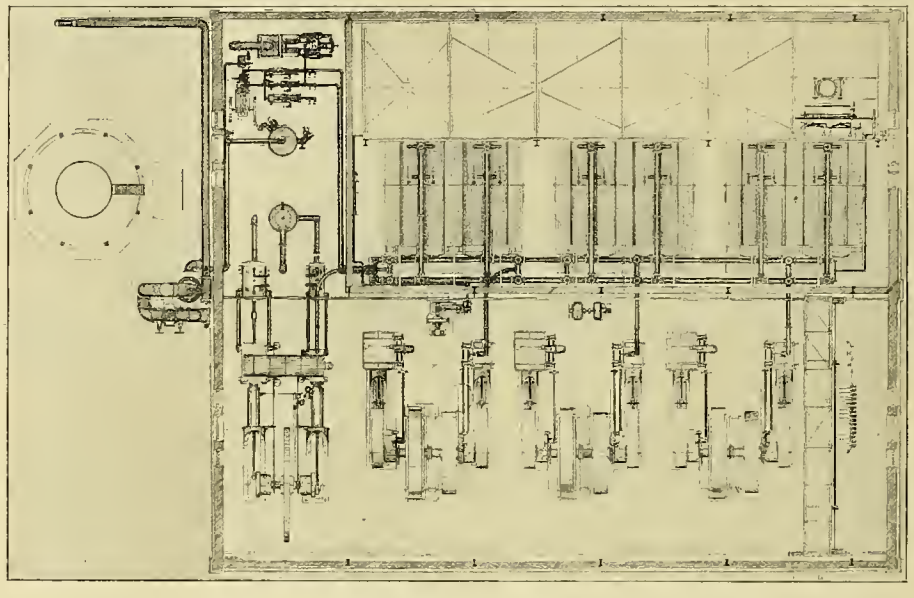


Fig. 2. plan of Power House.

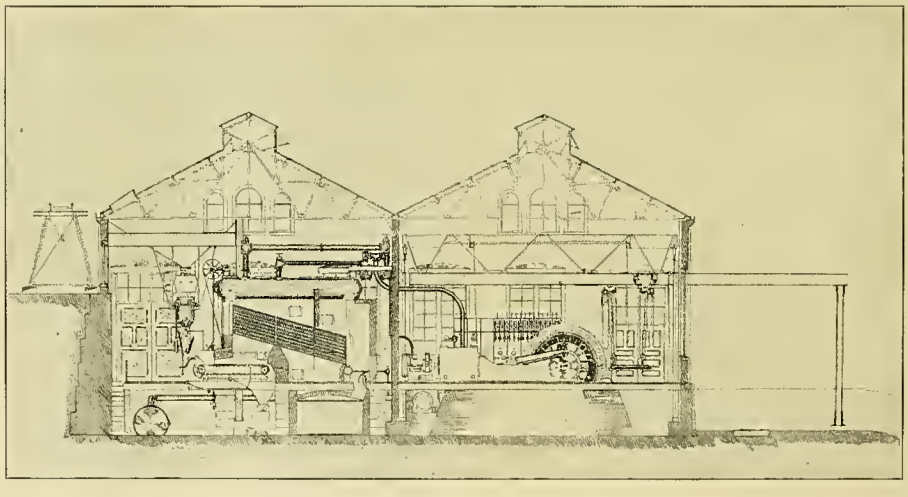


Fig. 3. Cross-section of Power House.

LA BELLA POWER PLANT IN THE CRIPPLE CREEK DISTRICT.

Creek railway. The La Bella company has issued a handsome souvenir pamphlet to commemorate the starting of its interesting plant, and Mr. Summers has prepared a "Power Booklet" for the use of the patrons of the company. The latter work is very complete and gives all needful information about the equipment and charges of the company.

New Storage-battery Grid.

Under date of September 23d the Western Electrician published a short description of a new form of storage-battery grid that has been invented by Mr. J. J. O'Connell, a Chicago telephone engineer. Since that time Mr. O'Connell has improved and cheapened his storage-battery plate to a considerable extent. The improvement consists in thoroughly tinning the steel (or possibly aluminum) plate, which in the ordinary form would be one-sixteenth of an inch in thickness, and then coating the plate on each side with a sheet of perforated lead. The perforations of the lead sheets are raised one thirty-second of an inch and are one-fourth inch in diameter. Deep receptacles are thus formed, which are so shaped that the active material will not drop out.

Power Development in the Mohawk Valley.

One of the newly projected power developments in New York state is that of the Empire State Power company, which is capitalized at $1,000,000, divided into 10,000 shares. The directors of the company are William T. Mayer of Albany, J. George Kaelber of Rochester, D. A. Devondorf of Fort Hunter, W. Barlow Dunlap of Amsterdam, Samuel Bolton, Jr., and Ralph S. Everest of Lansingburgh, and Clarence E. Sprcut of Williamsport, Pa. The point of this company's operations will be in the central part of New York state, it having acquired power rights along the Schoharie Creek, from Esperance, where the Delaware and Hudson Canal crosses the stream, to the junction of Schoharie Creek with the Mohawk River, the distance between the points being about 20 miles.

Within a few miles of this contemplated development there are several thriving manufacturing villages, where steam power is almost entirely used. The prospective market extends through the counties of Albany, Montgomery, Schenectady, Schoharie and Fulton. Prominent among the places where the company expects to find a market for its current are Gloversville, Amsterdam and Johnstown, all industrially prosperous. In time Albany may be brought into the company's domain.

POWER DEVELOPMENT IN THE MOHAWK VALLEY.—DAM SITE OF STATION NO. 1.

Within the 20 miles where the Empire company has secured rights there is a total fall of 320 feet, and the company expects to use about 200 feet of this fall at five stations, located at intervals of about four miles apart. Work has been commenced on the development of the power at Schoharie Fall, which will be known as No. 3 station. At this point there is a drop of about six feet in the river. A stone dam 12 feet high and 600 feet long will be constructed here. A canal about 14 feet deep, 70 feet wide and 4,000 feet long will conduct the water to a forebay 50 feet wide and designed to carry about 20 feet of water. From this forebay four penstocks, each about 8½ feet in diameter, will conduct the water to the turbines. From the forebay to the power house there will be a drop of about 20 feet, and an additional drop of 20 feet will be secured in a pit beneath the station, making a total drop of about 40 feet. The water will be returned to the river for use at the next station. The output of this station will be about 3,000 horse power, and it is likely that all of this power will go to Amsterdam; but Gloversville and Johnstown will also be supplied in time. The distance from the power station to Amsterdam is about seven miles, and a transmission pole line will be erected this distance. McDonnough & Cunningham of Troy, N. Y., are now at work on the excavation. This firm also has the contract for the masonry. Contracts for the machinery and transmission line will soon be awarded.

POWER DEVELOPMENT IN THE MOHAWK VALLEY.—DAM SITE OF STATION NO 4.

In the Schoharie Creek there are no high drops, but the main feature of the Empire State Power company's project will be the utilization of the force of a rapid-running stream, having no particular fall at any one point. The total development, as now contemplated by the company, is in the neighborhood of 15,000 horse power. When all the stations have been completed they will be connected by a tie line, in order that all the stations may be run in parallel as one station. It is the company's intention to build reservoirs for storage purposes, in order to supplement the dry-weather flow of the stream.

The company has secured the services of Wallace C. Johnson of Niagara Falls as chief engineer, and he will give his personal supervision to the work, so far as needed. Mr. Johnson is the chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company and has had an extensive experience in power-development projects.

Electric Lighting a Local Improvement.

If the water mains and hydrants of a system of waterworks, which extend along the streets of a city, are a local improvement, the Supreme Court of Illinois declares that it can see no reason why the poles, wires and lamps in an electric-light system are not also a local improvement. It takes the position that so far as the plant for lighting the streets by electricity includes the power house and generating plant, it may be regarded as improvements of general utility, and as not coming within the legal definition of "local improvements." But the poles, wires and lamps in an electric-light system are the means of furnishing the necessary light for the protection of the property of the citizens, just as the water mains and hydrants of a system of waterworks are the means of furnishing needed water for fire protection and other uses of the citizens.

It cannot be said that property upon a street lighted with electric light is not more valuable than property upon a street where there is no such electric light. Property is, in fact, especially benefited by electric or other adequate lighting along the street on which it is situated, quite as much as it is benefited by water mains. It follows that, if water mains are local improvements, poles and wires in an electric-light system are also local improvements. The former are conduits for water; the latter for electricity. So, also, it must be said that if hydrants attached to the water mains are a local improvement, lamps attached to the wires in an electric-lighting system are local improvements, because the latter are the means of using the electricity, as the former are the means of using the water.

The test whether an improvement is local or not depends upon the question whether or not it specially benefits the property assessed. The improvement which consists in the erection of poles, wires and lamps in an electric-light system is certainly as much a permanent improvement as the water mains and hydrants in a system of waterworks, and, the court holds, in the case of Ewart against the village of Western Springs, may be paid for by special assessment.

Pole-line Inspection in Michigan.

John E. Jones of Menominee, Mich., an attache of the state railroad commissioner's office, has been assigned the duty of inspection of all telephone, telegraph and electric wires which cross railroad tracks in the northern part of the state.

A report of each inspection must be made out and filed with the commissioner of railroads at Lansing. This report must give the name of the corporation or individual owning such wires as cross over a railroad track; it must also state whether the track is a main one or siding; where located; number of tracks crossed; condition of poles, wires, cross-arms, etc., and the distance of span; that is, the distance between poles. The state law says that poles carrying electric-light wires shall be not more than 60 feet apart, and poles carrying telephone or telegraph wires not more than 100 feet apart.

Mr. Jones says he found in Calumet at several crossings electric-wire poles 90 feet apart, and telephone-wire poles 115 feet apart. "However," said he, "the class and character of the pole lines in Calumet and vicinity will more than offset the extra number of feet between spans. The lines are most substantially constructed. In fact, all lines in the copper country are comparable to those found anywhere in lower Michigan. I never saw a better pole line than that carrying the Calumet and Hecla electric wires. The poles are exceptionally heavy, and the line is built in a manner suggestive of great durability."

Gas Engine Said to Be a Nuisance.

A gas engine was condemned as a public nuisance and detrimental to health by a jury in the District Court at Elizabeth, N. J., recently, and the owner, Frank Ratti, was sentenced to pay a fine of $5 and costs, or $25 in all. Ratti is a confectioner and ice-cream manufacturer, and used the engine in connection with his business. He ran it from nine o'clock in the morning until four o'clock the next morning, and, according to the New York Tribune, its incessant pounding noise racked the nerves of the women in the neighborhood, who complained to the Board of Health, which ordered Ratti to suppress the engine, but he refused to do so. The Board of Health consulted City Attorney Connolly, who informed them they had no case, and he declined to prosecute the offender. Then the health board hired two lawyers to proceed against Ratti, and he engaged a couple of lawyers to defend him. The case was tried by Judge Atwater and a jury of eleven business men, and lasted all day. Ratti may appeal.

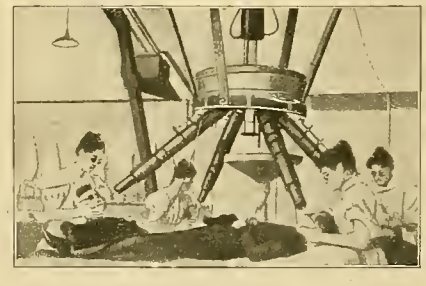
A franchise has been granted in West Virginia to the Kanawha Electrical company, to build an electric railway from Coalburg, Kanawha County, to Mount Carbon, Fayette County.

Skin Disease Treated by Arc Light.

It is not new to use the electric and other forms of light for the treatment of disease, and "electric-light cabinets" devised for this purpose are not unknown in this country. However, the idea seems to have been developed to a much greater extent by a Danish physician, Dr. Finsen, and his system is described in a recent article in the British Medical Journal, abstracted in the Literary Digest, from which the accompanying illustration is reproduced.

The method used consists in treating local superficial bacterial skin diseases by the concentrated chemical rays of light. In the treatment of patients, sunlight is used in the summer, when the sky is bright, otherwise the light of electric arc lamps of 50 to 80 amperes. It is only by concentration that the light becomes so powerful that its bactericidal property can be used in treatment. In order to avoid burning the skin, however, it is also necessary to cool the light. This double object—to make the light stronger and cooler—is attained by an apparatus consisting of a lens of about 20 to 40 centimeters in diameter. The lens is composed of a plain glass and a curved one, which are framed in a brass ring, and between them there is a bright blue, weak ammoniacal solution of copper sulphate. As one surface of the liquid is plain, the other one being curved, its optical function is that of an ordinary plain convex glass lens. By making the lens of a blue liquid instead of solid glass, a considerable cooling of the light will be obtained, because water absorbs the ultra-red rays, and because the blue color excludes a considerable amount of the red and yellow rays. These three kinds of rays have particularly strong heating effect, while their bactericidal power is insignificant. On the other hand the blue, violet and ultra-violet rays, which it is important to procure in as great a number as possible, are but very slightly impaired by passing through the blue liquid.

In the case of the electric light, a system of lenses enclosed in a tube resembling a telescope is used. This method is shown in the picture. An area of skin of about 1½ centimeters in diameter is treated for one hour every day. The treated skin reddens and swells, a bulla may appear, but necrosis has never been observed. The results, especially in the case of lupus, or tuberculosis of the skin, are said to be quite remarkable.



SKIN DISEASE TREATED BY ARC LIGHT.

Tesla Patent Case Decided.

An opinion has been handed down by Judge McPherson of Philadelphia in favor of the Tesla Electric company in the equity proceedings which it brought against Scott & Janney and others. The bill charged the defendants with infringing letters patent Nos. 511,915 and 555,190, relating to polyphase motors, granted to the plaintiff as assignee of Nikola Tesla. The first patent was granted for a method of electrical transmission and the second for an alternating motor, but both patents stand upon the same application and were attacked together on the ground that they were void for want of invention. It was argued that in view of the prior state of the art, and especially in view of an earlier patent of Tesla, the step from obtaining separately from the generator the two alternating currents, different in phase, that are required to operate the motor described in the earlier patent, to obtaining only one of such currents from the generator, while the other is obtained by induction from the primary current, was an obvious step, easy to be taken by anyone possessed of skill in electrical engineering, and therefore did not involve invention. Judge McPherson concluded that the step was taken in the exercise of invention. In concluding his opinion on this point of the defense he said: "So far as I can realize the situation, the two patents now attacked seem to me to be so connected with the earlier group that the same faculties that were necessary to produce those that are first in point of time must have continued in exercise to produce those that followed. It is often very difficult to draw the line between invention and skill, and different minds may draw it at different points. I submit my own conclusion for what it may be worth."

Judge McPherson held that none of the defenses submitted to the court could be sustained and that the motor of the defendants infringed all of the disputed claims involved in the suit. The patents in question are now owned and controlled by the Westinghouse Electric and Manufacturing company.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, = CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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Boston will be the center of interest for the telephone men of the country next week. The Bell company's suit for infringement of the Berliner patent will come to a hearing in the United States Circuit Court, and the course of the argument will be followed with eagerness. Eminent counsel are engaged, and probably a number of lawyers interested in the Independent movement will watch the proceedings closely, although not actually in the present case. If the Bell company shall lose in the final adjudication, it will have no further claim to fundamental patent monopoly in the telephone field. If, however, the last decision shall uphold the validity of the claims of the Berliner patent, it will then devolve upon the Bell company to show that every opposition transmitter in use or which can devised must infringe the patent—a very difficult task indeed. Many keen minds are now pitted against the assumed Bell telephone monopoly, and it will be strange if the Independent movement receive any very serious setback, whatever the result of the litigation. But, whatever the final outcome may be, it will not be reached for several years, in all probability. The Boston judge will naturally take time to arrive at a conclusion in such an important case, and there will no doubt be an appeal after that.

A Detroit correspondent writes: "R. H. Fyfe has resigned his membership in the Public Lighting Commission. Mr. Fyfe has given the public-lighting business his close personal attention since the municipal plant was established here, and now concludes that his private business interests are too important to allow him to give further time to the city service." Isn't this one objection to the public-ownership plan—the uncertain tenure of office of citizens of probity and standing who may supervise the plants? If Mr. Fyfe, for instance, had embarked his capital in a private lighting plant, he must of necessity have found a competent successor—in other words, another man who would venture his capital in turn—before he could surrender his trust.

It is noticeable that a number of new electrical plants and extensions of old ones are building or planned for the navy yards of the country. Several installations of this character have been noticed in the Western Electrician of late, and in the naval estimates of the year, as approved by Secretary Long, are a number of others. Following are some of the more important ones: The sum of $15,000 is asked for constructing electric elevators at the Boston navy yard. For extending the electric-light and power plant at the New York navy yard the sum of $50,000 will be required. For installing an underground-conduit system at the Washington yard $50,515 will be needed. An appropriation of $20,000 is wanted to increase the electric plant at the League Island yard and $5,000 for an electric-tramway line in the yard. At the Mare Island yard $50,000 is asked for a light and power station and $12,000 for extensions and changes of electric system. For increasing the electric plant at the Norfolk yard $35,000 will be required. The naval station at Puget Sound wants a telephone system to cost $2,500 and $7,000 to complete the electric-light plant. These estimates call for an expenditure of about $250,000 in a number of comparatively small improvements. When the larger jobs now specified are also taken into account, it is seen that the Navy Department is a large customer of the electrical companies for plants on land as well as for electrical equipment on shipboard.

Encouraging reports of prosperous manufacturing and supply businesses come from all quarters of the electrical field. It is said, for instance, that whereas a year ago the General Electric company was employing 7,500 hands in all departments, it now gives employment to nearly 12,000. This is a very large force, but the statement seems to be made on the authority of the company. Prices, too, have gone up, owing to the advance in copper and other raw material and the rapid increase in the company's business. The net increase in the price of the product is placed at a trifle over 16 per cent. An authority in the affairs of this company states that the volume of production this year is being based upon a maximum ability to manufacture $30,000,000 worth of goods. The company is now said to be working upon this basis, although it is stated that the minimum production will amount to $26,000,000 gross, as against about $18,000,000 last year. The company now has all of its plants in operation night and day, it is asserted, and is considering the advisability of making important extensions. Among these is the increasing of the foundry plant at Lynn, Mass. With the increase of the business the steady requirement for supplies for apparatus already in operation uses up about one-third of the capacity of all the plants. There has been a decided increase in foreign business, principally for railroad work, although mining and power apparatus is nearly as prominent. The experience of the General Electric company is probably a fair indication of the general increase of business in the electrical lines. After a long period of depression, the country was comparatively bare of electrical apparatus in stock, and it is likely that there will be a steady demand for several years to come. In business the action should equal the reaction.

In discussing the colloquial use of the word "juice," for the more studied "current of electricity," a Washington newspaper publishes an interview with "an expert in the car business" that is rather amusing. It seems that the word "juice" is by no means local to the city of Washington, but is used "wherever there is an electric or trolley-car line throughout the world." The word originated, it is stated, in Ireland, some of the workmen on the pioneer electric railway near the Giants' Causeway using it one day when "the electric fluid stopped." Of course, "fluid" would be the more proper term, the expert informs us, but "juice" seems to have come to stay. In Lynn, Mass., "where nearly all the car motors are manufactured," the word "juice" is probably heard more often during the day than any other. However, the purists—finical, Bostonian critics that they are—are not exactly satisfied with the widely known "juice," but advocate the more accurate and up-to-date "gravy." At this point we must do ourselves the pleasure of quoting the exact language of the Washington etymologist:

"Juice" has also been so generally introduced in the standard books on the trolley and motor service that it would be difficult to do away with it, even if it were necessary, which it is not, though at a recent convention of electrical car mechanics there was quite a discussion on the subject, it being contended that juice was not exactly the proper word and that "gravy" might be substituted. The electric fluid is more of a gravy than a juice, and some of the up-to-date electricians contended, as more had been learned of the real constituency of the electric fluid, that gravy would be a more expressive term than juice, but the juice people outvoted them, and it will probably never again be considered at a similar convention. In Boston, however, "gravy" is now heard more frequently than "juice," though the innovation has only taken root there.

May it not be that, owing to the similarity of sound and to gastronomical association, the reporter mistook the word "gravy" for "stuffing"? It is well known that the conducting wires are stuffed with electricity, and it appears to be evident that the newspaper man secured his information by a similar process.

If only the Lucania could be anchored in the Clyde and a few generators lowered into its hold and connected to its engines in place of the displaced propeller shaft, then, indeed, would Glasgow have an ideal railway generating plant—one that would undoubtedly meet the enthusiastic approval of the London Electrical Review. Experience in American railway power stations does not count; English marine engines, admirable for driving ships, are what is wanted to turn the electric generators of the street-railway plants of Britain. But, after all, American engines were ordered for the Glasgow plant, so that our dissatisfied contemporary may say, with a distinguished American statesman, "It's a condition, not a theory, that confronts us." Slow-speed engines built for railway work were wanted, and they were tendered and secured.

On one point we are glad to be enlightened by the Electrical Review. That journal seems to disclaim the intention of imputing possible collusion between the consulting engineer and one bidder in employing the ambiguous language which was quoted in a former issue of the Western Electrician. That language was as follows: "It appears that the Allis company accepted the dimensions of Mr. Parshall in toto: it would be interesting to know how he arrived at them." In explaining this, the Electrical Review now says: "No charge has been made in any English journal that the coincidence between Mr. Parshall's dimensions and the dimensions of Allis engines was a proof of collusion. It has remained for the Western Electrician to raise such a point. Obviously such conduct would be most dishonorable, and we do not believe many American engineers would be guilty of it." This is not entirely satisfactory, as he who notes the words "proof" and "many American engineers" will observe. The Western Electrician said nothing about proof. It merely asked if the language quoted did not convey an insinuation of possible collusion. The original sentence of the Electrical Review and the subsequent explanation are here given. Impartial readers may judge what they mean.

Care of Car Equipment.[1]

By J. H. Vander Veer.

In the maintenance of motor equipments to-day, where almost continuous service is demanded and high mileage made, only those equipments fitted with both oil and grease boxes will safely run over 40 days without a thorough overhauling. A large road will be obliged to do this overhauling at a number of different points. To overhaul a motor car thoroughly it is advisable to have at each overhauling shop extra trucks with motors mounted and all in first-class order ready to run under a car body whose trucks and motors need overhauling. To lift properly the body from the trucks four duplex chain hoists, or air hoists, conveniently located, together with two cross timbers and four stirrup irons, form as good a combination as can be found, and will do the work with the least possible injury to the car body. When body is lifted the truck to be overhauled is run out and the good truck substituted, car lowered, connected up and turned over to the operating department. The whole operation takes about one hour, and for that length of time only is the use of the car body lost. For convenience in overhauling, a suitable crane, properly located, equipped with a carriage and another duplex or air hoist, will be found of great convenience. Such a crane can be readily made in any blacksmith shop, and for the arm a piece of old rail can be used. When the motor is opened the armature should be lifted out and placed on a suitable rack, where commutator can be cleaned and armature tested for insulation. The fields should also be tested for drop, and where there is a drop those fields and armatures should be used in motors by themselves, keeping new and rewound fields and armatures in motors by themselves. This prolongs the life of the equipment and reduces the number of crippled cars taken off the road. The motor shell should be thoroughly cleaned out, either by compressed air or by washing with kerosene. The grease in the grease boxes should be taken out and put in the gear case and the grease boxes thoroughly washed out with kerosene. Brush holders should be taken out and thoroughly inspected and cleaned. At the same time you have the best opportunity for truck inspection. The writer has found that all overhauling done with car standing over the pits, the bottom half of motor dropped, does not allow the thorough overhauling necessary to keep the motor equipment in the shape it should be kept, besides tying up a complete equipment while such overhauling is being done.

In the matter of general inpection, a car started out, say, to-day, in perfect order, will safely run five days before being necessary to inspect again. To inspect from 20 to 25 cars per day, one man should be responsible for the proper inspection of all trolleys, including the taking out and replacing any defective poles, wheels or springs, and the straightening of all bent poles. Another man should be responsible for the proper inspection of all circuits, together with hood switches, fuse boxes and lightning arresters. Another should give his whole attention to controllers. The brakeman and his assistant should be able to keep all brakes in good shape and replace all worn-out shoes. This arrangement of inspection and overhauling should keep the truck and motor equipment in good shape, if the night men take equally as good care.

The writer recommends doing as little work as possible at night. At a car house operating, say, 100 cars three men should be able to grease motors, inspect brushes and make any small trolley repairs. Car cleaning should come directly under the operating department. The night-car cleaning should be limited to sweeping out, cleaning windows and dusting cars, while all washing should be done in the daytime while the car swings or is on the stand, if the car house is on one end of the line.

In connection with car cleaning, if the cars are of the closed type, with seat risers and drop sash, the space under the seat should be cleaned once a week, as the traveling public have a tendency to drop newspapers, apple cores, etc., down behind the seat back, not to mention the bits of lunch the motormen and conductors drop there if their runs compel them to eat on the car. The best way to avoid this, and also save the annoyance of rattling sash, is to make the sash stationary and cover over the space between the top of the seat back and sash rail. This, of course, does away with blinds and compels the use of curtains. The cost of maintenance is reduced by using curtains, and, at the same time, if you happen to be an official riding in a car of this type, you need not be in fear of a passenger pulling a blind with three or four broken slats, and the whole thing covered with dust so thick that you can write your name in it with your finger.

A car house from which 100 cars are operated should have a good carpenter, to make small running repairs and to take care of bell cords and register-ringing devices. Any car that has been in a collision and damaged so badly that it cannot be repaired in one day should be sent to the general repair shop. All cars should be taken to the general repair shop once a year and the body put in thorough repair and the car varnished or burnt off and painted anew, as the case may demand. While the car is in the carpenter's hands the wiring should be gone over carefully and put in shape. If the car goes to the shop with its regular truck and motors, the truck should be run out and gone over thoroughly. In case it is a built-up truck, all rivets and bolts are carefully inspected and renewed where necessary. In case of a solid side-frame truck, it should be carefully squared to see that it has not sprung. The brake rigging at this time should be taken apart, and if it is a truck with brake beams working in slides the beams should have what are termed "Dutchmen" jumped into the ends to bring the wearing parts back to their original thickness, as the beams will probably be found to have worn wedge-shaped. If the brake beams are hung by links, these should be renewed where signs of wear show. At this repair shop should be concentrated all classes of repair work, not only repairs to bodies and trucks, but all electrical repairs. The writer believes it pays for all railway companies to make their own repairs to electrical apparatus, including the making of armature coils and renewing of commutators.

In connection with the latter, the writer has found that hard-drawn copper makes the best commutator. This is bought in lengths and the bars sawed off with an ordinary metal saw. It will be found that the same bar will often do for several types of commutators. In making commutators yourself it is well to study out the diameter and increase that over those turned out by the factories as much as you can safely get between the brush holders. Drop-forged bars can also be had for any width of commutators you wish.

On repairs to controllers, hood switches, etc., most roads will find it cheaper to buy the ordinary repair parts and then assemble them themselves.

In conclusion, the writer has found it is advisable to make car-body repairs, painting, rewinding armatures, making commutators, armature coils, field spools, etc., by piece work. If good inspection is provided and the prices honestly watched, both the company and its employes are gainers by this method. The writer has in mind a case in point. A shop was operated by day work and the regular carpenters' wages were $2.25 a day of 10 hours. Cars that were being remodeled were costing $120. This was changed to piece work and each car given to four men for $110 a car. It was found that the men could do it easily for this and make about $6 over their regular wages. They soon became so expert at this line of work that the price was cut to $80 per car, gradually, and the cars are being turned out at this price now, and the men are averaging $2.50 a day. Close inspection, however, is a necessity.

Discussion.

E. G. Connette, Nashville, Tenn.: You all know that when a locomotive makes one trip, perhaps of 100 or 150 miles, possibly 200 miles, it then enters the roundhouse, and is inspected, cleaned and all necessary repairs made before it makes its next trip. On the line with which I am connected I adopted the method that, when a car comes in from its work at night, having run, perhaps, 100 to 150 miles, it is first cleaned, then inspected; all the parts of the motor, including the wire connections, the brush contacts and all the parts of the truck are properly inspected, loose parts tightened up and all minor repairs made to the car, and it is prepared then for its journey on the following day. My experience with that method for perhaps 10 years justifies me in saying that it has been entirely satisfactory. It is argued by some that daylight inspection is better, because the men have a better opportunity to see what they are doing, and feel more like working in the daylight than they do at night. That is true, to a certain extent; but, with a limited car equipment, and perhaps with the car barns located in such a manner that it would be inconvenient to have the cars run in during the day from time to time to have the inspection, cleaning and repairs made, it becomes necessary with some companies to do the work at night, and that to a large extent is so with the system in Nashville, and, as I stated, the system of cleaning, inspecting and making minor repairs at night has been very satisfactory. If a car goes out in the morning, and something occurs to disable the car, and it is brought into the shed, and it is found that the defect is caused by a lack of inspection at night, in such cases, of course, proper action is taken, and that is an incentive to the night inspectors to do their work properly, because if they do not do it, results will tell. The general overhauling is done by the regular repair force in daylight, and we make it a rule to have the motors overhauled perhaps once in six months—a general overhauling. About two years ago we had a large exposition in Nashville. During that period we hauled a large number of people, with trail cars behind every motor car, with a headway of from one to 1½ minutes regularly, and during the six months of the exposition there were but six motors disabled. I think that record will justify me in stating that the application of steam-railway methods to street-railway service has been entirely satisfactory to our company.

W. E. Harrington, Camden, N. J.: We operate at this time about 43 cars, and do the bulk of our inspection, minor repairs at night time. We do the general repairs, the carpenter work and painting work on the piece-work system, which has proved very satisfactory to us. One of the difficulties in adopting the piecework system was in establishing prices for the work, not having any precedent, as it were, and we struck upon a method of covering possible mistakes in prices by limiting the amount of bonus that we would give in this way: If we set a contract price for a piece of work, say $5, and the work was actually done for $2, that would make a profit of $3, which would be entirely disproportionate; so we settled on a limitation of that to 20 per cent. of the actual cost. If the work cost $2, and the contract price is $5, the actual bonus would be 40 cents; whereas, if the cost exceeded $5, the loss would not exceed 20 per cent. of the actual cost price. That seemed to satisfy the shopmen, and enabled us to settle quickly this question; and it has been very satisfactory in its operation. We followed this same practice in our construction work, as well as the repair work, and in every respect it has been very satisfactory.

The matter of car cleaning and washing with us is a very serious matter, on account of the great amount of dirt and dust which we have in the territory through which our cars run. We do our car washing at night, and do that on the piece-work system, also. We are washing 18-foot bodies for 15 cents a car, sweeping them out, dusting them and washing them thoroughly; and double-truck cars for 22 cents. The cost formerly was from 40 to 60 cents for the same cars. We have got the cost down to these very low figures and the work is being satisfactorily done. A point upon which I would like to get information is as to what is the general experience of the members in reference to the number of cars that are housed for repairs; taking the percentage of cars housed for repairs in proportion to the total number in operation. On our road, on the average, 10 per cent. of the number of cars in operation is sent to the shops for repairs. I think this point should be brought out thoroughly, as it is a guide to know how many equipments to provide, and I think it is a point which should be generally discussed.

J. H. Vander Veer, Brooklyn, N. Y.: In regard to the allowance of 10 per cent. as the number of cars housed for repairs, we find on the system in Brooklyn that on some lines it will average 10 per cent., but on others it will go as low as four per cent., depending a great deal on the service and the equipment we have at the particular depot. I think 10 per cent. of the total number of cars is an extreme limit.

Mr. Harrington: What effect would the question of having single-motor equipments and double-motor equipments on any ordinary road have on that percentage? We are running single-motor equipments, and I know that our depreciation is relatively high on our armatures and motor parts; and I ascribe a great deal of the percentage stated to be due to that fact. What is your experience in that matter?

Mr. Vander Veer: With the single-motor equipments I have fortunately had nothing to do in the last few years; but my recollection is that it is much higher than the percentage stated; it will run higher than 10 per cent. for single-motor equipments. Of course, the miles run per day and the style of motor will have a great deal to do with the question.

E. C. Foster, Lynn, Mass.: I would ask the gentleman if he considers there is any economy in operating a single motor on an ordinary car? As I understand the situation now, this gentleman has been speaking of disabled cars which are lying in the car house during a part of the day, and this disability, as I understand it, is due to defective apparatus. He says that 10 per cent. of the cars are in the house all of the time. It seems to me, if that is a fact, we should go into the subject further and ascertain if there is any profit in running single-motor cars. I would say for the benefit of the association that our experience on a suburban and interurban road is that we have not found it profitable to operate single-motor cars, probably on account of the increased expenses incurred in the maintenance of them, as compared with the double-motor cars. This past season we have been operating one 10-bench open car, with one pair of "G E 57" motors, each having a capacity of 52 horse power, making the two motors 104 horse power. That, you will recognize, is an excessive amount of power required to operate a 10-bench single-truck car. But the result, so far as repairs have been concerned, have been very satisfactory, there being no repairs necessary on that car during the entire summer. We have not even worn out one pair of brushes; the car has made about 120 miles a day. I believe it has been customary in the past to operate a motor of small capacity, and by reason of that small capacity your expenses of maintenance have been increased very materially. There is only one other matter I would refer to, and that is if the gentleman has any figures as to the cost of painting or varnishing the cars—cleaning up and varnishing the cars. I would like to get the figures for the labor.

Mr. Harrington: We have been using single-motor equipments practically up to date, with the exception of a few double-truck cars, recently purchased. About one year ago we equipped one 18-foot body with double equipments, and where we averaged a car in the house, say once in every 10 days with the single-motor equipment, that car has only been in the house three times in a year, and that for only petty repairs. On the strength

[*Continued on page 273.*]

1. Read before the American Street Railway association at Chicago, October 18, 1899.

DEVELOPMENT OF THE TELEPHONE FIELD.

Niagara Falls Home Telephone Company.

The city of Niagara Falls is soon to enjoy the benefit of competition in its telephone service. In the past the Bell company has had a monopoly of the telephone business of that growing city, but at last the Independent movement has reached there to make the people happy. The new incorporation is known as the Niagara Falls Home Telephone company, and the directors are W. R. Campbell, A. H. G. Hardwicke, James E. Rock, Hon. Walter P. Horne, Samuel B. Rawson, Fred. H. Sudro, James A. Dake and Irving H. Griswold.

The new company has made a contract with the Rawson Electric company of Elyria for a 1,000-instrument exchange, complete, for $55,000. The Eureka switchboard will be used and a full-metallic

A. H. G. Hardwicke.

Dr. W. R. Campbell.

NIAGARA FALLS HOME TELEPHONE COMPANY.

service given to each subscriber. The men interested intend that the exchange shall be as complete as any in the country. The Independent company is making contracts for business telephones at $3 a month, and $1.33 1-3 for residence telephones a month. This service will be given any place in the city, the distance from the exchange having no influence on the price. As stated, each subscriber will have an independent service in a residence for $1.33 1-3 a month, whereas, under the Bell contracts people who are on a line of three telephones are known to be paying $3.59 a month, and others possibly are paying more. It will be observed that there is a marked difference, all in favor of the Independent company.

The new company is erecting its poles at the present time and the construction is excellent. It is evident, from the crossarms being placed, that many wires will be used. The contracts made with subscribers are not binding until 250 telephones are in use. However, the company will start with about 400 instruments in place, which is certainly a good-sized exchange, especially so, considering the fact that the August official list of the Bell people gives a total of 343 subscribers in Niagara Falls.

The energy with which the Independent company has gone to work has had the effect of stirring up the Bell people to try to retain the business. However, there has been growing a fierce opposition to this company among those who have had to do with it in telephone matters, and these people are welcoming with open arms the Independent company, realizing that opposition must accomplish numerous benefits to their interests. Much of this feeling is due to the outrageous rates the Bell company has been charging. The way in which the war is being carried on is well portrayed by the following advertisements, printed side by side in a local paper:

In another advertisement the Bell company threatens to give telephones away, in these words: "A city directory with half the names of people is just as valuable as a telephone system with half the number of subscribers. Our new switchboard is built for 2,100 subscribers. We may have to give telephones away to reach this number, but we will get there." However, the old company has never been known to give anything away. It looks very much as though its business was to be won by the Independent company by a superior, individual, metallic service.

It has been announced that the Bell company will build a new exchange, and it is now putting some of its wires on three streets in conduits. The new exchange will be a well-built building, and will be located on Ferry avenue, near Third street. No doubt the people will appreciate this addition to the buildings of the city. The Bell company, since the Independent company was developed, is installing the Barrett system of party lines, and now has some 25 telephones of this class in operation. The Bell company has also adopted a new rate schedule, with which the canvasser is expected to be around about the time the Independent company is installing a new telephone.

There is a general expectation that the Independent telephone movement will spread in western New York, there being every prospect that Lockport and North Tonawanda will get in line next spring. While the contracts of the Niagara Falls Home Telephone company call for a service by January 1, 1900, every effort is being made to have the exchange in operation by December 1st, which would give a month to perfect the service before the rental is charged.

Messrs. Campbell, Hardwicke, Rock and Horne, the local men interested, are men in whom the people of Niagara Falls have confidence. Dr. Campbell is a leading physician; Mr. Hardwicke is of the plumbing firm of Hardwicke & Co.; Mr. Rock is a leading dry-goods merchant, while Mr. Horne is a hotel proprietor and former postmaster. They are men of position and their integrity adds strength to the new movement.

One-minute Schedule in Michigan.

The Michigan Telephone company will add Grand Rapids and the intermediate towns between Grand Rapids and Kalamazoo to the list already operating under the one-minute toll-line schedule. The company is able to do this by the addition of four copper metallic circuits between these places, which, in connection with the lines built westward from Detroit during the early part of the summer, will afford instant communication with Grand Rapids. Since the beginning of the minute service on the Detroit-Kalamazoo route business has increased to such an extent, the company says, as to make it evident that this radical departure from the old five-minute basis is a step in the right direction. "Our subscribers," said E. D. Trowbridge, superintendent of the long-distance service, "are beginning to see the advantage of this rate. They are cutting down their conversations, limiting them to the business which they wish to transact, many of them coming within the one-minute limit. By doing this subscribers are able to use the telephone oftener and at an expense even less than for one-half the number of messages under the five-minute rate. The rate to Grand Rapids is 30 cents."

MANUFACTURERS AND DEALERS.

The Farr Telephone and Construction Supply company of Chicago states that its business is constantly on the increase and the demand for its goods seems to be growing every day. The company has just issued a new catalogue, No. 10, which is also a hand-book of information. Many new features are included in this hand-book. It contains a number of new diagrams which will be of special interest to those about to install telephone plants. Any telephone man who will send for a copy of this new catalogue will doubtless feel repaid for his trouble.

Berliner Hearing Next Week.

Telephone users, operators and manufacturers who employ apparatus not made by the Bell company are greatly interested in the case of the American Bell Telephone company against the National Telephone Manufacturing company of Boston, which is set for a hearing on November 7th, in the United States Circuit Court for the Eastern District of Massachusetts, in Boston, probably before Judge Brown. This is a suit brought for the alleged infringement of the famous Berliner patent. F. P. Fish and F. H. Betts will probably appear for the Bell company and Edward P. Payson for the defendant.

Among telephone men the Berliner patent is recognized as the last remaining hope of the Bell people in the way of any fundamental patent monopoly. It was issued on November 17, 1891, to Emile Berliner of Washington, D. C., for a "Combined Telegraph and Telephone," and is No. 463,569. Although issued late in 1891, the application for the patent was filed on June 4, 1877, 14 years before, and it was charged that fraudulent practices were resorted to to delay the issue of the patent until near the date of the expiration of the original Bell patent, so that the telephone monopoly might have a renewed lease of life. Accordingly, a suit was begun by the United States government to annul the patent on the ground of fraudulent collusion by Patent Office employes with the Bell company, and also on the ground that the device described lacked novelty and was already covered in a patent granted to Berliner. The bill was filed by the attorney-general early in 1893, and the case came to a final decision by the Supreme Court of the United States on May 10, 1897. However, only the question of fraudulent delay in the issue of the patent was considered in the ultimate decision, and the merits of the patent itself were untouched. The Supreme Court decided for the Bell company on the fraud charge, holding that there was no evidence to show corruption. Thus the patent stood, but with no decision on the validity of its subject-matter.

Before the Supreme Court decided in its favor on the question of fraudulent issue the Bell company brought suit against the National Telephone Manufacturing company for alleged infringement of the patent. This is the case that is still pending and which will come to a hearing next week. The bill in this suit was filed on August 5, 1895, and in the intervening time the testimony of experts and others has been taken, the introduction of evidence having been interrupted by the arguments and disposition of the government case. The record in the case, with the lawyers' briefs, will be submitted to the court next week, and oral arguments will also be made.

It is pointed out, on behalf of the opposition companies, that the only court that has passed on the merits of the infringement question (the United States Circuit Court presided over by Judge Carpenter of Boston) decided against the Bell company. However, should the validity of the claims of the Berliner patent be upheld, it will not follow that every form of transmitter is an infringement or that good non-infringing transmitters may not be devised.

Rumored Combination of Telegraph and Telephone Systems.

It is rumored in Philadelphia, according to the daily press, that the organizers of the Continental Telegraph, Telephone and Cable company, recently incorporated in New Jersey, have obtained control of all the Independent telephone companies in the United States and aim to combine these with the great telegraph companies and the five Atlantic cable companies. Among the capitalists reported as being interested in the venture are George J. Gould, John Jacob Astor, William C. Whitney, P. A. B. Widener, Martin Maloney and William L. Elkins. The story is said to have been verified by Mr. Widener, who says that the new enterprise will bring about a sweeping reduction in the cost of transmission of electrical messages all over the country. Naturally, however, the report of such a seemingly impossible combination will be received with great reserve.

EXTENSIONS AND IMPROVEMENTS.

The Cumberland Telephone and Telegraph company will extend a branch line from Waverly, Tenn., to Linden.

The Alabama, Mississippi and Tennessee Telephone company has completed its extension from Toccopola to Dallas.

The Jo Daviess County (Independent) Telephone company, operating in Jo Daviess County, Ill., reports that it has franchises in all the incorporated places in the county, and now has a full metallic circuit from Stockton to Greenvale, Nora, Warren, Apple River, Scales Mound, Vita Grand, Millbrig and Galena. It has exchanges at Stockton, Nora, Warren, Apple River, Scales Mound and Galena, and they are all said to be working nicely. The exchanges and connections of the company are owned by L. D. Pitcher, the president and general manager of the Lee County (Ill.) Telephone company.

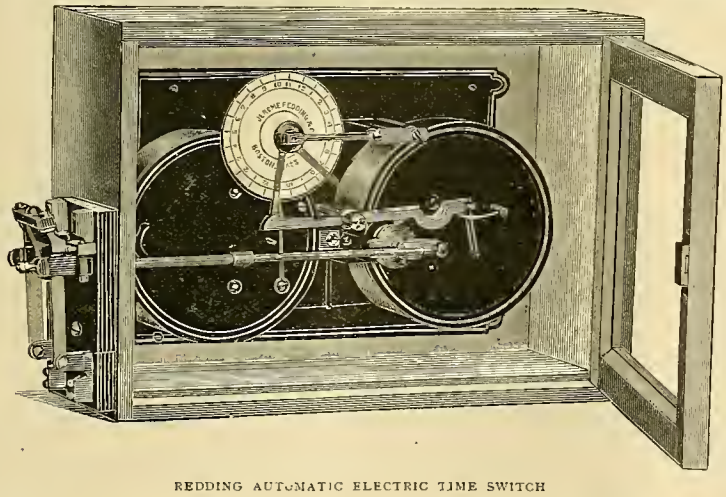
International Brotherhood of Electrical Workers.

The sixth biennial convention of the National Brotherhood of Electrical Workers was held in Pittsburg from October 16th to 21st. Over 100 delegates were in attendance. The convention was presided over by President J. H. Maloney of Chicago and the delegates were welcomed to the city by Mayor Diehl and Morris Mead, chief of the Bureau of Electricity of Pittsburg. Reports of the president and secretary showed that the organization now includes 84 local unions, 42, with a membership of about 5,000, having been added during the last two years. Most of the time of the convention was taken up with reports of standing committees and the reading and discussion of papers. It was voted to make the association international and change its name to the International Brotherhood of Electrical Workers. The following-named officers were elected: President, Thomas Wheeler of Cleveland; vice-presidents, R. P. Gale of San Francisco, F. J. Sheehan of Hartford, Conn., R. R. Tripp of Houston, Tex., F. H. Russell of Baltimore, Md., and F. H. Roth of Atchison, Kan.; secretary, H. W. Sherman of Rochester, N. Y., treasurer, P. H. Wissinger of Baltimore. The selection of the place of the next convention will be made by a vote of the local unions comprising the international organization. It is likely that St. Louis will be chosen.

Redding Automatic Electric Time Switch.

An automatic electric time switch is being placed on the market which is said to be of great practical value. The instrument is designed for use in places where it is desired to light and extinguish incandescent or arc lamps automatically and at certain specified times. It is adapted for use in stores to light up the lamps in show-windows; in apartment houses, to light the lamps in the halls on the approach of darkness, and extinguish them at the proper time in the evening, and in all other places where it is desired to light or extinguish lamps or turn on or turn off the current for any purpose, at more or less frequent intervals. It is also valuable for the main-service switch in large buildings, to turn off the current at night and at other times when not in use, to prevent loss of current by leakage and to avoid the risk of fires.

The switch is said to be particularly applicable to the control of the current where flat contracts are made to operate motors, electric heaters and other apparatus during certain hours of each day, not only for the purpose of securing the exact and automatic turning on and off of the current at the proper times, but also to prevent the use of the same beyond the time agreed upon and paid for.



REDDING AUTOMATIC ELECTRIC TIME SWITCH

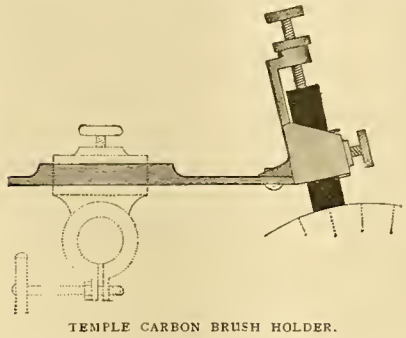
The instrument is provided with an accurate eight-day clock movement and time dial, to show the exact time of day and to operate the switch. It has a knife switch, which can be made of any capacity required. The switch is controlled by two brass arms placed on the time dial (one to close and the other to open the circuit), which can be set at any time desired, and when so set are carried around by the dial, and at the designated time press against the ends of two levers shown in the picture, and operate the switch to open or close the circuit, as desired. The illustration shows the instrument set to close the circuit at 7 p. m. and open it at 11 p. m. It can be made to operate at more frequent intervals by placing additional arms on the dial.

These time switches have been in practical use for nearly two years, and it is said that they have given satisfaction in every respect. They are manufactured by Jerome Redding & Co., 48 Hanover street, Boston, who will be glad to furnish any information regarding them to interested persons.

The Equitable Heat, Light and Power company of Davenport, Ia., has been incorporated with $200,000 capital stock. A. J. Robertson and G B. Nye are among the incorporators.

Temple Carbon Brush Holder.

The frame or holder proper of the Temple carbon brush holder, illustrated by the accompanying picture, is made from hard brass, the binding screws used being large in section with knurled head and check-nut on adjusting screw. The rear extension of the holder is made of hard-rolled copper the same width as the brush it carries, and at the point where it is held in the holder by a stud it is built up to the thickness of the brush intended to be used. In the use of carbon brushes on generators a common drawback is that no adequate provision is made for holding the carbon brush securely in the brush holder and at the same time maintaining a constant spring tension on the brush. In many generators using carbon brushes the contact between brush and holder is obtained by a spring which, at best, makes only an imperfect and therefore high-resistance contact, which accounts for the slow "picking up" of the generator, and also excessive sparking, especially on bipolar machines.



TEMPLE CARBON BRUSH HOLDER.

Sparking is also due to too much contact of brush on commutator where copper brushes are in use. A brush to give the best possible results, on a dynamo or motor, should never lap more than two segments. The Temple brush being securely fastened in the brush holder and delivered to the commutator endwise, is said to accomplish two important ends. Being clamped securely in the holder it makes a perfect and low-resistance contact between brush and holder, reducing the tendency to heat and also makes the generator "pick up" quickly; in fact, makes it possible to use carbon brushes on small bipolar generators. A second advantage is claimed that by being delivered endwise to the commutator it prevents the possibility of excessive brush lap. A comprehensive pamphlet, describing the brush holder, will be sent inquirers by the manufacturer, the Clay Electric and Manufacturing company, 210 Illinois street, Chicago.

New Method of Electrical Execution Proposed.

It is asserted that the French government is considering the advisability of discontinuing the use of the guillotine for the execution of criminals and the adoption in its stead of a method in which needles charged with high-tension currents are shot into the brain, causing instant death. According to the accounts given, the head of the criminal, as he sits firmly strapped in the execution chair, is to be enclosed in a helmet similar to that of a diver. Opposite the temples of the wearer are two holes, through which the needles, duly connected with the source of electric current employed, pass. As the executioner touches a button, and so turns on the current, the two needles leap from their sockets and are forced through the temples into the brain of the criminal. With them they carry powerful alternating currents, which rupture and destroy the brain cells with such rapidity that, it is apprehended, one convulsive movement of the victim will be the only sign that life is extinct.

Care of Car Equipment.

[*Continued from page 271.*]

of the record of that car, our board of directors has concluded to order double equipment for 12 of our cars, as a starter. Our armature depreciation has been, in my judgment, tremendous and altogether out of reason. On a 40-car road we have one armature man busy all the time, doing nothing else but looking after the armatures, and I think we will be able to put him on some other work in conjunction with the armature work as soon as we have more of these double equipments. Just the exact cost of depreciation on single equipments it is difficult to say, but we are sure we will cut it down with the double equipment. In reference to the cost of painting, while I have not definite figures in my mind, I can give you a general run of the work. The cost for the car to be taken into the house, the paint burned off and the car painted and varnished on the outside throughout, with the inside varnished (contract price), is $20. For ordinary touching up and varnishing outside, with paint already on and one coat of varnish on the inside for an 18-foot car, the contract price is $6. The cost of material is approximately the same as the labor.

Mr. Foster: Do you do the work by the week or by the hour?

Mr. Harrington: We pay the painters $2.50 and carpenters $2 a day for that class of work.

W. P. Read, Salt Lake City: What is the number of coats of varnish you are under contract to receive when the cars are revarnished?

Mr. Harrington: The usual formula right straight through—putting on the first coat and the rough stuff, rubbing down, putting on the first coat and rubbing that down and putting on three coats of varnish afterward. There are really five distinct steps in the operation.

Mr. Connette: There is one element of saving in running single motors, where they can be conveniently run, and that is in regard to the power used. In Nashville, Tenn., there is very little level ground; it is up-hill and down-hill everywhere. I tried an experiment in the running of a single motor, and found by test that it used about 35 per cent. less power than with double equipments, but we could not use the single motor for the lack of traction. Most of our roads have no loops at the end, and consequently the ends of the car are reversed, and when the motor was in front there were many places where it was quite difficult to get up with a single motor, on account of the lack of traction. When the motor was on the rear axle, of course, that difficulty was not so great. But there is a saving in power by the use of a single motor. It strikes me that where single motors are used, that fact would, to a large extent, limit the capacity of the car, or the size of the car, in proportion to the power of the motor used. In Louisville, Ky., where they operate possibly 200 or 300 cars, it has been my observation that nearly all of them are run with one single reduction motor only. Their cars are small, most of them having been old horse cars converted into electric cars, and, the city being comparatively level, I understand they operate very satisfactorily.

R. M. Douglass, Cleveland: It seems to me that this question of single and double-motor-truck cars depends a good deal on the condition of the track. I represent the "Big Consolidated" road of Cleveland, where we recently have had a little disturbance, and we have some bad track, the same as most other cities. We have some old Johnson rail on chairs, and all that kind of thing, and our people have recently purchased 150 double-truck cars, modern cars in every respect. One motive in getting these cars was to keep up with the times and handle our people in the best way. Another reason was that we have some bad track and by putting the double-truck cars on this track the cars would run smoothly over the track, which was almost impossible with the single-truck cars. It is a question of track, to a great extent, regarding single and double-truck cars. I think single-truck cars of from 18 to 21 feet in length can be operated easier and simpler than double-truck cars; and I do not think we should discard the use of such cars if our track is in good condition. It strikes me that the question of the track is largely a factor in this matter.

When I went to the "Big Consolidated" road, the 1st of May, I found contracts for the painting of the cars were in force there, and they were unsatisfactory. The company was paying 25 per cent. more for painting, touching up, burning off and varnishing, as the different requirements called for, than it actually costs now by days' work, and we are getting fully as good work. Under the contract system, they were painting the window glass and daubing things generally. We get much more satisfactory work by the day, and I think we save 25 per cent. That will apply to painting and varnishing. We have a contract for making armature coils and doing similar kinds of work, which is extremely satisfactory. We have that contract still in force, and that is the only contract work we do.

Now, about trolley wheels. When I went to the Brooklyn Heights road, about five years ago, they were manufacturing their trolley wheels out of zinc, brass and copper. I have often thought since why we did not put in a brass foundry to make the trolley wheels. We are buying castings in the

rough, and turning them down half way and putting in the bushings. I wonder why we do not make these castings ourselves and scrap our old copper and brass at 15 cents a pound, before paying such large prices for new wheels. I believe, however, that the Brooklyn Heights company has discontinued that practice. I would be glad to hear Mr. Vander Veer's experience on that line.

Mr. Vander Veer: With regard to the brass foundry, while it commends itself to a large road, our experience was that our men made things out of brass that should have been made out of iron; and we shut down the foundry for a while. We started it up again a short time ago.

Mr. Douglass: Is it not economy to make your own wheels on a road of your size?

Mr. Vander Veer: Yes; it is profitable.

Mr. Douglass: A saving of 25 or 30 per cent.?

Mr. Vander Veer: Yes; fully that; but there is always a tendency to drift off into other things.

Mr Douglass: I am surprised that more of us do not make our trolley wheels.

J. J. Beggs, Milwaukee: The question whether roads could profitably manufacture trolley wheels like many other things in use on the road, would depend on what they are compelled to pay for them. I have a contract for trolley wheels at the present time, made according to a formula, which on our lines seems to be the most advantageous, as to the proper degree of hardness of trolley wheels to give best results without wearing the wire, and which shall preferably wear the wheel, at 23 cents per pound, and a contract for converting the worn-out trolley wheels into others of equal weight. I do not believe that any road can afford to put in a brass foundry and make its own trolley wheels if it can buy them at that price. We can get 16 cents for the old wheels.

Mr. Douglass: That is the rough casting?

Mr. Beggs: That is the finished wheel—a wheel five inches in diameter, which is somewhat larger than the wheels on many other lines. We believe in large wheels, because they run at less speed. Our trolley wheels weigh approximately nearly 3½ pounds finished. You take that, with the bushing, and I do not believe there is any road that can maintain a brass foundry profitably, when they can buy their wheels at that price. The argument is often made by municipalities that they can operate street railways and electric-light plants and other public utilities at less than we gentlemen, who are in the business, can do it. Very many times your special foundries in connection with your road are not charged off where they should be .charged; that has often been the case with the brass foundries and other appliances run in connection with the road; there is nothing charged off for superintendence, and you fail to charge the percentage of capital represented, and everything of that kind. When it touches that particular point I do not believe that any road which is in a position to make a proper contract for trolley wheels can begin to make them as advantageously as some manufacturer who has other things to make in connection with the trolley wheels. It depends very largely upon the contracts which the road is able to make on trolley wheels. In view of the difference in cost of material in the last 12 or 15 months, I am paying now about 30 per cent. more for trolley wheels than under a contract made 18 months ago, and in order to get what was a satisfactory figure to me, knowing the relative difference in value of the copper, zinc and tin entering into the composition of the trolley wheel for our use, and in order to get that figure I made a contract for 5,000 wheels, to be delivered to us at the convenience of the shop turning them out, made according to our formula and pattern, and they can turn them out "between times" in their shop. I know that I could not run a brass foundry and begin to turn these wheels out for what they cost us to-day, under a 5,000-wheel contract.

I do not believe any road can judiciously run single motors. I have not believed so for the past 10 years. The 35 per cent. of power saved, which has been referred to here, I think, is threefold paid for in greater cost of repairs to single motors and other portions of the car. I think the cheapest thing virtually that we put on an electric railroad is the power that moves the car; it costs less than almost anything else going into the car. Three and a half years ago we adopted a standard car on our lines—a double-truck car. We have steadily advanced upon that and improved that equipment, until we put 25 cars on this year, and we will put on about 35 new cars annually, in order to keep up our equipment. They are double-truck cars and are standard. For three years we contented ourselves with two motors on these cars. We put on 25 cars this year and have contracted now for 30 to be delivered in April next, on which we put four motors, a motor on each axle, as an element of economy and greater facility and give to the public good service. The traction is much better, and we can speed up a car more quickly, and when you take a city where you stop every block, it is an important item if you can save a few seconds in making these stops and in getting the cars in motion. We find that it costs less for the maintenance of a car with four motors than for the maintenance of a car with two motors. The actual cost of maintaining the equipment under the car is reduced and the number of cars in the shop averages only two per cent. We seldom have to pull one of these cars into the shop. The motors are not overworked. If a car gets behind its time it has the reserve power to enable it to make speed, which is an important element in the economical running of a street railway. If you can take five minutes out in the length of a run, it is a great saving. For instance, we run pretty long lines, few of them less than seven or eight miles from terminal to terminal. We make 200 stops possibly in that distance, and a second or two saved in each stop, in getting up speed on the car, means a considerable amount in the number of cars necessary to equip and maintain the schedule. We have experimented on this subject very carefully. We know, of course, on our four-motor equipment—speaking offhand, without figures—it possibly requires 30 per cent. more power than to run two-motor equipments to pull the same car, but we are moving at higher speeds, saving money in other matters, and giving much more satisfactory service to the public, and we are saving wear and tear on the equipment. The cheapest thing we have on the road is power.

Mr. Foster: What type of motor do you use?

Mr. Beggs: We adopted as standard the "G E 1,000" motor. We put one motor on each axle. We have several grades, none very severe, but we have no trouble from slippery rails or frost in winter, and with our four-motor equipment we never think whether the car is going to get over the line. The number of flat wheels is greatly reduced, and in every way the cost of maintenance on a four-motor equipment is 25 per cent. less than on a two-motor equipment. We have cars built seating 44 passengers, 22 double seats. We frequently have over 100 passengers on these cars, on account of there being wide platforms, the car being 41 feet over all. That is the car we have adopted as standard, after experimenting for three years, both as to the amount of power consumed, wear and tear on the cars and rails, and while we are running more motors on our lines, I do not think the number of men in the armature department is one-half what it was three years ago.

Mr. Connette: I do not mean to advocate a single-motor equipment, but I do say this: That for small cars, where the streets are comparatively level and where the power of the motor is in proportion to the size of the car, that it can be operated for less expense than a double-motor equipment. I know by actual meter tests that for an 18-foot closed car body, single truck and double motors, that it requires about 150 kilowatt-hours per day, for 125 to 140 miles. The cost of power, of course, varies, but a fair average is one cent per kilowatt-hour. Therefore, if you use 150 kilowatt-hours per day for each car and you save 33 1-3 per cent., the saving of power would be 50 cents per car per day, and where 30 cars are run it means $15 a day for power, and it strikes me, from the experience I have had in maintenance, that it will not cost as much to maintain one motor, even with a little extra service, as it does to maintain two motors. We think with two motors, with the ordinary motor used—four fields and two armatures—with all the incidental connections, it is common sense to state that if you are only running one motor, even with extra service, it would not cost as much to maintain it in the course of a year as to maintain two motors. But when the element of service enters into the question in larger cities, where you have to get larger cars and higher speeds and heavier travel, then, perhaps, our judgment would change in favor of the double motors, because you can get more effective and satisfactory service with two motors on a car than you can with one motor; but so far as the element of expense is concerned, I believe it is more economical to operate one motor than two motors, where it can be done, and I believe that is limited to the smaller places and to places where the streets are comparatively level.

Mr. Foster: I would ask Mr. Beggs one question, and that is the average speed made by the four-motor equipment cars, and also if he uses power brakes, and if so, what kind?

Mr. Beggs: We do not use power brakes on our city equipments. In fact, where we run local service we have some cars equipped with air brakes, but shut them off in the local service. We try to maintain a speed of 8½ miles over the whole system. It is an important element to take into consideration in connection with Mr. Connette's remarks. We maintain possibly the longest headway of any city in the United States for a thickly populated city, and one of the elements is the large cars and the great regularity maintained in the timetable, which is kept up as closely as on steam roads in the city traffic. We maintain, even on our lines where we stop every three or four hundred feet, an average of 8½ miles an hour, and on some lines nine miles an hour and over. There is none of the equipment which makes less than 160 to 170 miles daily to a car. On our interurban lines we make as high as 380 miles a day to a car, day in and day out.

Mr. Foster: What type of motor? Is it a different type?

Mr. Beggs: The same motor exactly. We have to take the conditions into consideration, as Mr. Connette says. We have a considerable number of interurban lines spreading out like the spokes of a wheel, and we are trying to standardize the equipment, so that if we need to send cars out on any line they have the element of speed connected with them. These cars are equipped with the ratchet brake. On our high-speed interurban lines, where we make 19 trips a day, we keep that up with two cars on daily service. We maintain that service, and have done it for 18 months, with two cars, making 19 trips a day of 20 miles each. On these lines we have air brakes and arc headlights, which are absolutely indispensable to a high-speed interurban line.

Mr. Foster: What is the maximum rate of speed on the interurban line?

Mr. Beggs: I should say that on certain portions we reach a speed of nearly 50 miles an hour. The line runs between the city of Milwaukee and the city of Waukesha, and we have six or seven miles in the city limits where we go into the local service. The cars become part of the local service when they enter the city limits. The speed on that line is anywhere from 30 to 50 miles an hour. On our city lines we have high-speed gear.

Mr. Foster: Is the road on a public highway or private right-of-way?

Mr. Beggs: That particular line I refer to is on private right-of-way. We have one interurban line, 35 miles in length, on a public highway. We do not get that speed on that line, but hope to reconstruct it so as to be able to do so.

A. E. Lang, Toledo: In Toledo we are operating a street-railway and an electric-light plant combined, and we maintain a brass foundry. We pay our brass-foundry man $1.75 a day, and he is a good man. He spends his entire time in the brass foundry, and he takes every scrap of brass that we have and works it into every available place on the car, in the lighting plant and about the power house where brass is used, and we are satisfied beyond any doubt that it is a most economical way to operate this part of a railroad. We cast our own trolley wheels. As I say, every brass fixture appertaining to the car is manufactured from our own furnace.

With respect to the double-car equipment, it depends, I think, very largely upon local conditions with respect to grades. We are operating two motors on each car, our standard being the No. 3 Westinghouse motor. We have a few "G E 800" motors. A suggestion that I desire to make that may be of value to some of you is the fact that we have just entered upon a method of splicing two 16-foot car bodies together. It has been a serious question with us what to do with four-wheel cars that have been in operation from eight to 10 years, and following the same line of procedure that they adopted at Columbus about three years ago, we have just taken two 16-foot car bodies and spliced them together and put them on double trucks, and we have placed these cars upon one of our longest lines, where we have been maintaining a nine-minute headway for some two or three years, and found a necessity for shortening the interval. To overcome that necessity we have concluded to put these double-truck cars upon that line. We have had them in service about 60 or 90 days; they look exactly like new cars. An expert could tell the difference, but the people who ride in them say: "What a magnificent car this is." They are pleased beyond measure with the new cars, and we think by that means that we are going to still maintain our nine-minute headway without complaint, because they take more passengers and their speed is just as good as a 16-foot car. It was argued that we would not be able to maintain our speed, using two 25 horse power motors, but in our city, where we have few grades, we find that we can maintain our speed just the same with our double-truck car as we did with our single 16-foot car, and you can see that it can earn a great deal more money, and I think that where the situation of roads is similar to our own, that you will find it of great advantage to take some of these cars that are nearly ready for retirement, and by putting in new sills and bracing them up properly, you can utilize them for a long time.

Mr. Foster: Can you give us an idea of what it costs to reconstruct the two cars into one?

Mr. Lang: It costs in the neighborhood of $300 for labor and material entering into the reconstruction of the car body. The car has a longitudinal seat.

W. S. Dimmock, Council Bluffs, Iowa: I would say that our company took 16-foot car bodies that had been in service for between six and seven years, spliced them together and made a 42-foot car over all, including vestibules, and have run them for five years, and outside of the painting we have had no repairs practically to speak of since the day they were rebuilt. I think the splicing of these cars cost us in the neighborhood of three hundred or four hundred dollars; I have forgotten the exact amount. We find that the double-truck car is better for the service. It was claimed that we could not keep up our schedule on the same headway, after splicing these cars; and especially so after putting gates on them. We equipped these cars with gates which are operated with a lever controlled by the motorman, and we find that the power consumed is somewhat greater than it was before the gates were put on, on account of the additional number of dead stops required to be made. Nevertheless, the car is giving better service, and running on the same time card as with the 16-foot car, the speed of the car in many places being as high as thirty miles an hour, and the repairs are not more than they are on the up-town cars, which are only 16-foot cars.

Mr. Beggs: I would like to ask as to the cost

of splicing the two 16-foot car bodies referred to, whether that makes provision for the trucks?

Mr. Lang: No, sir.

Mr. Beggs: What kind of trucks do you put under them?

Mr. Dimmock: Double trucks.

Mr. Beggs: That is an important question, because we have canvassed that matter back and forth, and finally determined that it is not economical to splice our old car bodies, for the reason that by the time you have these trucks under the car, the cost of the car—while still an old car, and which will begin creaking after a short time—is fully half the cost of the best car that can be built, and after spending this money in splicing these cars you still have an old car. As Mr. Lang has said, local conditions have a great deal to do with it. We in our city up on the lake, for instance, this summer have had very little warm weather to require people to go out and take car rides in open cars. We ultimately intend to dispense with the open cars and get the equipment down to standard equipment, to be run 12 months in the year. To-day we put cross seats in our cars, and we must have greater width than with the longitudinal seats. Our cars are eight feet six inches wide, giving two cross seats with a good aisle, and about 33-inch cushions on the seat. We made a careful estimate of the cost of reconstructing the old car bodies, and we found that it would cost one-half of what we could buy the most modern car for with seven-inch sills; and we did not consider it a matter of economy. We do not want any longitudinal seats on our line. Our patrons prefer our standard car, and with the window sash down it is virtually an open car for all intents and purposes. Our cars are ready to run the whole year around. The amount of money spent in splicing these car bodies does not begin to include all the expenses involved, and then you have nothing but second-hand equipment. I think you will all admit that when you take an old car body, built for the lighter traffic of 10 years ago, and endeavor to reconstruct that car, it will only be a short time before the car begins to creak again at the joints.

Mr. Dimmock: We have run our cars five years without repairs, but in order to make our car as good as we thought it ought to be, we had a steel frame put around the bottom of it, with truss rods, which has caused the car to stand all the racket of bad track, etc. I will admit one point, however, that if we were buying new cars we would prefer them lighter, with cross seats. As to the open cars, we also spliced our 16-foot open cars, and the difference in the two cars is that the closed car seats 44 persons, while the open car seats 75. Another feature was the track centers. Our track centers will not permit of a wide car, and this fact aided us in making a decision to splice the old cars. If the track centers had been wider we might have considered the purchase of new cars. We feel we are money in pocket by the splicing of the old cars, under the circumstances which exist in our city.

Mr. Foster: What is the depth of the flange on your wheels, Mr. Beggs?

Mr. Beggs: I think 1⅛ inches.

Mr. Foster: Do you run them over a girder rail or a tee rail?

Mr. Beggs: Our standard roadbed construction is a tee rail, with granite headers and stretchers. We form a groove out of the granite, and if you came to the city of Milwaukee, you would see the same effect as with a grooved rail, without the gnawing. In the city limits every foot of track is put down so as to admit paving in any way that the city wishes to do it. We use six-inch tee rail, weighing 70 pounds to the yard.

Mr. Dimmock: I would ask if any of the gentlemen present have kept the mileage on the trolley wheels?

Mr. Beggs: I will say that we get about eight or nine thousand miles from our trolley wheels. I know of roads that get as high as 17,000 miles. Our policy is to prefer to wear the wheel. Our wheel is made up of a composition of 86 per cent. of copper, eight or nine per cent. of tin, and four or five per cent. of zinc, and we get a composition which wears the wheel rather than the trolley wire. Our trolley wire is No. 0000 over our entire system. We get about 9,000 miles from our trolley wheels and do not want any more. It costs less to wear a trolley wheel than it does to wear a trolley wire. The cost of putting up the wire is as great as the wire itself. I know there are certain roads that make a boast of the number of miles they get out of a trolley wheel. They used a steel wheel in Milwaukee three years ago and were grinding the trolley wire constantly.

Illinois District Telegraph Company.

The Illinois District Telegraph company has been organized to assume control of the delivery service of the Western Union Telegraph company in Illinois and will operate in direct competition to the American District Telegraph company. The new company is organized on similar lines to the new companies now operating in Indiana, Iowa, Kentucky, Michigan, Missouri, Minnesota, Ohio, Oklahoma Territory, Pennsylvania, Wisconsin and West Virginia. Its officers are the following-named gentlemen: President, H. D. Bennett, Columbus, O.; vice-president, W. J. Lloyd, Chicago; secretary, G. H. Johnson, Columbus, O.; treasurer, E. M. Mulford, Jr., Chicago.

Public Lighting in Detroit.

The Detroit municipal electric-lighting plant has increased the city street lighting from an average of 1,744 arc lights of 2,000 candle power each to 1,868 arc lights of 2,000 candle power each, and the electrical output from 3,281,615 kilowatt-hours to 3,539,567 kilowatt-hours, while it is said that the total cash expended for the operating and maintenance of the entire plant has been reduced from $99,713.18 to $96,665.03, bringing the stated cash outlay per arc light per year down from $51.85 to $46.46.

A reduction of wages in the lighting department is due to the introduction of longer burning carbons, permitting the double-carbon lamps to be trimmed on alternate days instead of daily. There are 87 employes. The work of trimming the lamps is entrusted to the care of a chief trimmer with 16 men. The single-carbon lamps are located in the "underground" or business district and are trimmed daily. The double-carbon lamps are located in the residence districts and are trimmed every second day, each trimmer having two circuits to care for. Within the half-mile circle all the wires of the city are underground. The conduits vary in size from two ducts to 24 ducts, according to the possible demands upon them. The ducts are in a special three-inch vitrified tile, laid in concrete.

The overhead lines of the plant are strung on 6,673 poles, or a total of 405 miles of wire. The lights are placed on towers, posts or center suspension, as the conditions demand.

In addition to the streets, the public buildings lighted by incandescent lights are: City hall and county offices, Public Library, Municipal Court, Board of Health, Water Board, Police Department, Fire Department, Board of Education, normal and night schools, Capitol Square fountain and U. S. S. Yantic. The assessed valuation of the plant is $400,000.

Opposition to Electric Railroads in Ohio.

Injunction proceedings have been begun in the Circuit Court of Lucas County, Ohio, to prevent the Toledo, Norwalk and Fremont Electric Railroad company from further laying its track in public highways. A dispatch from Toledo says that there was an array of legal talent on both sides, and by the decision of the court will be determined the fate of a number of such roads now in process of construction or projected in the state of Ohio. The ground on which the attorney-general is fighting the road is that the county commissioners have granted the road a right of way along the Maumee turnpike, which, being a public highway, cannot be given to a corporation for private purposes. The attorney-general also asked $20,000 for damages already done.

CORRESPONDENCE.

New York Notes.

New York, October 28.—An attempt is being made to settle the question of the running of automobiles in Central Park. Winslow E. Busby and Whitney Lyon, members of the Automobile Club of America, rode to the Plaza entrance to Central Park in an automobile yesterday afternoon and insisted that they had a right to enter the park in their horseless carriage. Mr. Busby, the owner and driver of the vehicle, was arrested, and a test case will be made of the matter. Repeated attempts have been made to induce President Clausen of the park board to issue permits for private automobiles to enter Central Park, as they have been permitted to use all other parks of the city, but all applicants have been refused. It has been pointed out that no ordinance against automobiles has ever been passed, and that horseless vehicles have been excluded by the police solely on a verbal order from President Clausen. Mr. Busby and members of the Automobile Club hold that the attitude of the Park Department is unreasonable, and they have determined to force an issue.

For members of the Automobile Club of America and their friends a run has been arranged for November 4th. Starting from the Waldorf-Astoria at 10 o'clock in the morning, the route will be to Ardsley, where dinner will be served, and the run home will be late in the afternoon or in the evening. The club is the first organization of automobilists in the United States. Adjutant-general Avery D. Andrews was elected president, and General George Moore Smith, Homer W. Hedge and Winslow Busby were appointed as a temporary committee on membership. H. W. Hedge was elected temporary secretary. Steps to procure a clubhouse, it is said, will soon be taken.

Owing to a legal hitch the lights in the streets of Staten Island were not turned on during three nights this week. A conference between representatives of the New York and Staten Island Electric company and Comptroller Coler to-day resulted in an agreement being arrived at by which the company will accept $150,686.21 for lighting to June 30th, and consequently the lights will be turned on again to-night.

According to Russell Sage plans have been submitted to the directors of the Manhattan Elevated Railway company by Vice-president Skitt for the change of the motive power to electricity for the lines of the company's system. It is expected that the new electrical system will experimentally be in operation on part of the system early in January and the entire change will have been completed within a year. Probably the first line to be equipped will be either the Sixth avenue line or the Third avenue. Both the multiple-unit system and the electrical locomotive system may be used, according to which system is best adapted for the respective lines and branches of the road.

After considerable inconvenience and delays the electric-car service on Third avenue was put in smooth running order last Tuesday. The company hopes to have the entire road running by electricity within two weeks.

The electric railroads of the western end of Long Island will soon be in the hands of two companies, the Brooklyn section and outlying points under the Brooklyn Rapid Transit, and the Long Island City, North Shore and cross-island roads under the New York and Queens County Electric. The New York and North Shore Railway company, which has absorbed the Long Island Electric company, which started to tap the Rockaways by a turnpike across Jamaica Bay, will probably begin to run cars from Flushing to Jamaica within 10 days. The Long Island Electric company has about 25 miles of street railways and connection with the Kings County Elevated running through the Jamaicas and thence to the Rockaways, and holds some valuable franchises not yet taken advantage of.

Arrangements are being made by the board of governors of the Automobile Club for the coming automobile show, which will be one of the novel society events of the winter season. M. L. G.

Northwestern Notations.

Minneapolis, October 28.—The city of Tower, Minn., contemplates putting in an electric-light plant. There is $8,000 available in the treasury, and and if a plant can be put in for that figure, it will probably be done.

The city of New Prague, Minn., has bought the electric equipment of the lighting plant. The old firm retains the boilers and engine and will furnish the power until July 1, 1900, when the city will put in a new and larger boiler and engine and dynamo probably.

Plans are being prepared for an electric-light and waterworks system at Olivia, Minn.

The city of Duluth, Minn., has engaged an engineer to look over the city and make an estimate of what will be needed when the city concludes to build an electric-light plant.

The Owatonna (Minn.) Electric company has been reorganized and some improvements are projected. Additional machinery will be put in.

The Street Railway company has begun work on a new car barn in Spokane, Wash., which will include shops, offices, etc., at a cost of $20,000.

W. I. Gray & Co. of Minneapolis secured the contract to furnish the electric equipment for a municipal plant for Austin, Minn., at $12,900. The Twin City Iron Works of Minneapolis will furnish the power plant at $4,960.

The Twin City Electric Railway company has been formed to build an electric railway between Aberdeen and Hoquiam, Wash.

The city of Brainerd, Minn., will expend $8,000 in new machinery for the electric-light plant.

The street-railway company at La Crosse, Wis., declines to vestibule its cars in accordance with the demand of a state official and insists that the protection which they give, amounting to a screen in front, complies with the law. A test may be made in the courts.

The council of St. Paul has adopted specifications for next year's lighting. They are drawn to secure the widest competition. The city is divided into districts, so that small plants may compete for a single district.

Mr. Kerlin of Minneapolis contemplates establishing an electric-lighting plant in Grantsburg, Wis.

W. I. Gray of the electric-contracting firm of W. I. Gray & Co., Minneapolis, and president of the Board of Electricity of Minnesota, was married October 19th, at Plainview, Minn., to Miss Isabelle W. Willis.

The old electric-light plant at Brookings, S. D., has shut down and the new one is being put in shape as rapidly as possible.

The electric-light plant at Clinton, Wis., has been shut down, as it was not a profitable investment. There is talk of the municipality purchasing the plant.

The Kaukauna (Wis.) Electric company has received orders from the city to place its wires underground at once, at the rate of two blocks a year.

The new co-operative electric-light plant for Grand Rapids and Centralia, Wis., has been completed and put in operation.

The Butte Electric Light company of Butte, Mont., was awarded the contract to furnish electric street lighting for 10 years, in accordance with its recent proposition.

Work has been begun for a new power house for the electric-light plant at Aberdeen, S. D., which is to be removed to the gas plant.

Lake City, Minn., will raise $6,000 to purchase a new engine and dynamo.

The Triumph Electric company has the sub-contract to furnish the electric equipment for the electric-light plant at Lakefield, Minn.

Small boys are under arrest at Council Bluffs, Ia., for stealing the copper bonding wires from the rails of the street-railway company. They also took

some of the ground wire. This stealing has been going on for months and has caused the company a great deal of trouble.

City Engineer Claussen of St. Paul would install a garbage crematory and use its heat to furnish power for an electric-light plant.

The electric-light plant at Manson, Ia., is to be materially enlarged by the addition of considerable machinery, and all-night service will be given.

Complaint is made at Oshkosh, Wis., that the electric headlights of the Citizens' Traction company cars are too brilliant and dazzle the eyes, making it difficult to drive on the street toward them.

The interurban electric line between Tacoma and Seattle, Wash., will be built at once, and it is expected to be in operation by June 1, 1900. The line will be slightly over 30 miles long. The contract for construction has been let.

Moorhead, Minn., will install meters for its electric-light customers, beginning December 1st.

J. G. Strawn has sold his interest in the electric-light plant at Vernon, Wis., to James Treseder of Viola, Wis.

The electric-light plant at Manson, Ia., has been sold, the change taking effect November 1st, to Des Moines people.

The council of Des Moines, Ia., has discovered, to its surprise that the street-railway company has a perpetual franchise to haul freight through the streets of Des Moines, instead of for eight years, as was supposed.

Dr. M. P. Turner, the founder of the street-railway system in Des Moines, Ia., died recently. When the town was small he secured a franchise for the whole town. He operated just enough cars to hold the franchise and hung on, though many attempts were made to annul it. At times he was in dire poverty, but he never gave it up, and finally he sold the system, of which the franchise was the only thing of value, for $340,000. The line was at once torn up and an electric line established.

The electric-light company of Austin, Minn., has enjoined the city from contracting for a municipal plant. The matter will be argued before the court at the next term of court.

Christian Burkhardt of Hudson, Wis., has sold a share of his interest in the Apple River water power to the St. Croix Power company for $41,000. The latter is installing a system at a cost of $450,000 to furnish power for Stillwater and St. Paul, Minn.

Fargo, N. D., capitalists are considering the feasibility of an interurban electric loop, from Fargo to Harwood, Argusville, Gardner, Grandin, Mayville, Portland, Arthur, Hunter, Casselton and Mapleton and back to Fargo. The estimated cost to construct and equip such a line is placed at $1,000 to $1,500 a mile.

The McCartney street-car system in Green Bay, Wis., has been transferred to the Fox River Electric Railway and Power company, which is now operating it. This places all the street cars under one management.

The Westinghouse company is reported to contemplate establishing an immense electric plant at Taylor's Falls, Minn., about 50 miles from the Twin Cities, by developing the water power there and transmitting it by wire to Minneapolis. The plant would cost about $750,000.

Mr. Gould of Kalispell, Mont., contemplates establishing an electric-light plant in Libby, Mont.

The Granite-Bimetallic company of Philipsburg, Mont., is working on the development of Flint Creek Falls, for electric power. This work was first started in 1891, and has continued, with interruptions, ever since. It has progressed so far that it is expected to have the plant delivering power by February 1st. The ore mills will be operated by electricity thereafter. It may also be employed in the treatment of ores. R.

PERSONAL.

L. W. Burch, president of the Electrical Supply company of Madison, Wis., was a Chicago visitor last week.

Charles H. Perrine of Chicago has opened an American office for the Tramway and Railway World of London at 825 Monadnock building.

Professor Andrew Gray, professor of electrical engineering and physics at the University College of North Wales, Bangor, has been appointed to succeed Lord Kelvin in the chair of natural philosophy at Glasgow University.

Dwight Townsend, at one time president of the United Lines Telegraph company and associated with John W. Mackay and Robert G. Ingersoll in the formation of the Postal Telegraph company, died at his home, in New York, on October 29th, aged 73 years.

Mr. F. W. Cushing, who lately returned from Europe, is credited with the plan of building a $125,000 summer hotel on the North Shore, between Highland Park and Fort Sheridan. Mr. Cushing was formerly a prominent electrical man in Chicago. He has spent much time abroad in the interest of Dr. Gray's telautograph.

Captain Charles E. Hall, an old resident of Chicago and former superintendent of construction for the Chicago City Railway company, died at his home, 19 Groveland Park, Chicago, on October 26th. Captain Hall served in the Civil War, and in 1855 was engaged in the building of railroads in Cuba, having constructed the first line ever operated on the island.

Major Richard H. Willoughby, associate editor of Electricity, died at his home in Brooklyn on October 22d. His death was indirectly due to a fall received on alighting from an elevated train. It was at first thought that his injuries were slight, but on the day of his death he was suddenly taken worse and soon expired. Major Willoughby was a veteran of the Civil War, during which he earned his military title. He was an experienced newspaper man, and his death is deplored by those who knew him well.

C. S. Knight, vice-president and general manager of the Siemens & Halske Electric company of America, has resigned. He will be succeeded by O. S. Lyford, Jr., the electrical engineer of the company before it passed into the control of the Electric Vehicle company. Mr. Knight will go to New York to take up another line of work with the syndicate which controls the Siemens & Halske, Electric Storage Battery, Electric Vehicle, Illinois Electric Vehicle Transportation, New York Gas and Electric Light, Heat and Power and other companies. Mr. Knight has been with the Siemens & Halske company only about seven months, but it was long enough for his capacity and energy to manifest flattering results. Mr. Knight is a widely known, experienced and energetic electrical man. He has exceptional executive ability, which will prove valuable wherever he is engaged.

Mrs. T. R. Mercein, wife of the well-known and well-liked secretary of the Northwestern Electrical association, died in Milwaukee on October 20th. Mrs. Mercein was afflicted by a cancerous growth. An operation was performed, but the sufferer did not have sufficient vitality to rally from the operation. Mr. Mercein and the two children were with the wife and mother when she died. Mrs. Mercein was an exceptionally brilliant woman, possessing a charming personality and a cordiality and graciousness of manner that won her many friends. She was a woman of fine intellectual ability and had written both prose and verse of exceptional merit. She was greatly interested in the Society of Colonial Dames, being president of the Milwaukee branch, and was also a member of the Daughters of the American Revolution and other social and charitable organizations. Mr. Mercein's electrical friends extend their sincere sympathy in his great loss.

Mr. Charles T. Hughes, the manager of the New York office of the General Electric company, was the recipient of a handsome loving-cup on October 21st, from all the members of his staff. The occasion of the presentation was the fact that on that day 20 years had elapsed since he first entered the employment of Thomas A. Edison. Since that time Mr. Hughes has been continuously in the employment of Mr. Edison or his successors. The cup was made of Dorflinger green glass, with heavy sterling mountings and the usual three handles. Around the outside of the rim were the inscriptions: "Charles Turner Hughes from his Staff. Thomas A. Edison. October 21, 1897. The General Electric company. October 21, 1899." On the inside of the rim was "Twenty Years of Active Service." Mr. Theodore Beran, manager of the supply department of the New York office, made the presentation speech, and Mr. Hughes responded for himself and Mrs. Hughes, who was also present. During the afternoon Mr. Hughes received the personal congratulations of Mr. Coffin, president of the General Electric company, General Griffin, first vice-president of the General Electric company, and many other members of the company. He also received congratulatory telegrams from members of his own staff in Buffalo, Syracuse and New Haven, who were unable to be present.

ELECTRIC LIGHTING.

The town of Hebron, Neb., has decided to erect an electric-light plant.

It is estimated that the lighting of the Paris Exposition will call for 20,000 horse power.

The village of Newton Falls, O., has voted to bond the town for $5,000 to establish an electric-light plant.

The Frankton Water Works and Electric Light company has been incorporated at Frankton, Ind., with a capital stock of $17,000.

The Cicero (Ill.) Water, Gas and Electric Light company has sold its properties in Oak Park to the Chicago Suburban Water and Light company.

The Auburn Electric Light company of Auburn, Ill., has been incorporated with a capital stock of $8,000 by J. A. Wheeler, W. H. Ramsay and George W. Hutton.

At a recent meeting of the City Council of Austin, Minn., it was decided to build an electric-light plant, to be owned and operated by the city. The plant is to cost $20,000.

The stockholders of the Binghamton (N. Y.) General Electric company held their annual meeting recently and elected the following-named directors: Colonel George W. Dunn, George F. O'Neil, W. A. Tucker, P. L. Saltonstall, Stephen C. Normile, James H. Roberts and G. Brodie Smith. The directors organized as follows: President, Colonel Dunn; vice-president, George F. O'Neil; treasurer, P. L. Saltonstall; attorney and secretary, James H. Roberts, and general manager, Stephen C. Normile.

The Chicago, Burlington and Quincy Railroad company has just commenced to equip locomotives with electric headlights. The famous "Fast Mail" and "Denver Limited" travel at such a high rate of speed that a stronger light than the old-style has has been found necessary for safety.

John S. Cravens of Pasadena, Cal., has been elected president of the Edison Electric company of Los Angeles, to succeed George H. Barker, who recently resigned to accept a responsible position with the General Electric company. The Edison Electric company is one of the largest electric-lighting concerns in California. It owns the Southern California Power company, the Pasadena Electric Light and Power company and the Santa Ana Gas and Electric company, and has a branch line to Pomona. It secures its power from the Santa Ana River, the power house being near the mouth of the Santa Ana Cañon, about 12 miles from Redlands.

It is stated that Mrs. Charles Parkes of Waterbury, Conn., has brought suit for $25,000 damages from the electric-light company of that city for the loss of her hand, which, she says, was permanently crippled by leakage of electricity in the shrubbery at her suburban home. Mrs. Parkes gave a garden party some time ago and had electric lights strung in the shrubbery. During the entertainment she walked out upon her porch and took hold of the bushes in which were hung electric lights. She says that she received a shock which burned the flesh almost completely off her fingers. She asserts that the company is responsible for the improper leakage of electricity.

ELECTRIC RAILWAYS.

The Findlay Street Railway company has increased its capital stock from $150,000 to $275,000.

The Southwest Missouri Electric Railway company of Webb City, Mo., has filed a statement of increase of capital stock from $650,000 to $830,000.

The council of Plainfield, N. J., has granted a franchise to the Plainfield Street Railway company to extend its line out Park avenue to the city limits.

A charter has been granted in Kansas for the Fidelity Bell Railway company to operate an electric line from Mineral to Galena, Kan. The capital stock of the company is $70,000.

The Chicago, Cicero and Northern Electric Railway company has applied to the town board of Cicero, Ill., for a franchise to build and operate a street-railway system in Cicero.

The Middletown-Goshen Electric Railway company has been incorporated at Middletown, O., for $100,000, to construct and operate an electric railway. Among the incorporators are W. E. Boyce and H. B. Boyce..

The Willimantic (Conn.) Street Railway company has been organized with the following-named directors: W. H. Abbott, J. M. Pettis, W. W. Tuttle of Boston; W. D. Grant and G. K. Nason of Willimantic. The company expects to have its cars running by June, 1900.

A recent London dispatch states that the London County Council has adopted the conduit system of electric railways on the projected large extensions. This is the first time an English corporation has adopted this method, overhead wires being in use throughout the United Kingdom. This innovation was only accomplished after considerable opposition.

An injunction was granted against the Wichita (Kan.) Railway, Light and Power company, on October 26th, in favor of the city, forbidding the company from operating its railway lines and ordering it to remove its tracks, cars and wires from the streets of the city within two weeks. The city claims that the company has forfeited its contract by failing to keep up the service.

After a fight, which lasted nearly three years, the village trustees of Mamaroneck, N. Y., have voted to grant a franchise for a trolley road on the Boston post road to the Tarrytown, White Plains and Mamaroneck Railroad company, which is now a branch of the Huckleberry company of New York. The franchise is for 100 years and the company is required to have the road in operation by January 1, 1900. It does not include the village of Larchmont, the residents of which are bitterly opposed to the trolley and have refused to give it a franchise by a unanimous vote.

AUTOMOBILES.

A branch factory for the manufacture of electric vehicles may be established in Buffalo by the Woods Motor Vehicle company of Chicago.

A very successful test has been made in Detroit, under the supervision of Postmaster Dickerson, of a three-wheeled electric vehicle. The trial consisted in covering a route of about 12 miles and

collecting mail from about 70 mail boxes in one hour and 13 minutes.

The commissioners of the District of Columbia have decided that a steam engineer's license is necessary for operating on the streets of Washington automobiles run by steam generated from gasoline, benzine or other fuel. Operators of electric vehicles are not required to take out licenses.

It is stated that an automobile service is to be established in Atlantic City, N. J., next spring by the Scott-Janney Electrical company, which was recently incorporated at a capitalization of $30,000,000. The organization of the transportation company is said to be in charge of H. W. Woolverton, president of the New York Transfer company, who is also chairman of the transportation committee of the Scott-Janney company. Sixty carriages, each having a capacity of 22 passengers, will be put in operation on the line.

PUBLICATIONS.

The North Electric company of Cleveland, O., has recently issued pamphlets describing its farmers' community telephone systems, small switchboards for exchanges needing less than 50 drops and lightning arresters, high-tension and sneak-current protectors.

The 1900 catalogue of the American Miniature and Decorative Lamp company of New York has recently been published. It contains a complete list of miniature lamps and was evidently compiled with considerable care. The product of this company is the result of the ingenuity of H. J. Jaeger, the manager and electrician of the firm.

The Eagle Paint and Varnish Works of Pittsburg, Pa., of which Mr. M. B. Cochran is proprietor, have issued a neat circular which dwells on the Eagle insulating varnish for electrical purposes. Many claims are made for Eagle varnish, which is guaranteed to afford absolute insulation wherever used. A sample can be had for the asking.

The Fort Wayne Electric Works, manufacturers of the Wood systems, have issued a bulletin regarding its low-speed, belt-driven generators for light and power. These machines are said to be so designed that any change in load within the capacity of the generator does not necessitate the shifting of the brushes to prevent sparking at the commutator. A table of dimensions, capacity, etc., is given of the generators from 30 to 260 kilowatts.

As a typical example of the application of storage batteries to telephone plants the Electric Storage Battery company of Philadelphia has issued a circular describing the installation of chloride accumulators in the Bell telephone exchange in Philadelphia. A number of the large telephone exchanges throughout the country have adopted the "central-energy" system, and a list of 40 companies using the chloride accumulators is given in the circular.

An interesting and exhaustive article devoted to the "Westinghouse Industries" appeared in the Pittsburg Dispatch, under date of October 18th. A page was given to the description and illustration of the three large institutions located in Pittsburg which have sprung from the inventive genius and business energy of Mr. George Westinghouse. The concerns described are the Westinghouse Air Brake company, the Westinghouse Machine company and the Westinghouse Electric and Manufacturing company.

The Edison Manufacturing company of New York, manufacturer of the well-known Edison-Lalande battery, has issued a new booklet (No. 4) which gives much interesting information regarding its battery. This battery, it is claimed, is especially adapted for gas engines and automobiles, and is put to many other uses where a battery is required that can be depended upon. It is claimed the Edison-Lalande Battery will not freeze and is liquid-tight. Those interested in batteries are asked to write for a copy of the company's booklet.

A directory of Chicago streets, office buildings, banks, railroads, etc., has been compiled by George W. Patterson, the western agent for the American Circular Loom company and Gordon batteries, and is being distributed by Mr. Patterson to his friends in the electrical fraternity. It is carefully prepared and, being of vest-pocket size, will prove a useful and convenient guide. It contains two maps, one being a compact map of the entire city, the other showing the downtown business district. An especially meritorious feature is a system of numbered references to the larger map, by which any street may be located by consulting an alphabetical list in connection with the map.

POWER TRANSMISSION.

The Oroville Water and Power company of Oroville, Cal., has been incorporated with $300,000 capital stock. C. P. Lott, E. W. Fogg, J. C. Osgood, R. S. Powers and P. R. Parsons of Oroville are directors of the company.

At the recent annual meeting of the Clear Lake Electric Power company of Napa, Cal., the following-named directors were elected for the ensuing year: President, Richard Wylie of Napa; vice-president, Captain J. K. Fraser of Lakeport; E. P. Clendenin of Stockton; general manager, E. H. Winship of Napa; secretary, R. Raymond of Napa; treasurer, Harvey P. Goodman of Napa.

All the water rights and other property owned by the Flint Creek Electric Power company of Philipsburg, Mont., have been transferred to the Montana Electric Power and Mining company, which was organized in May with $500,000 capital stock.

The Lake View Valley Power company has been incorporated at Redlands, Cal., with a capital stock of $200,000, by Dr. N. Bridge, E. L. Conger, I. Bailey and others of Pasadena. The company has acquired power rights on Mission Creek, 18 miles east of Redlands, where a large plant will be erected.

P. L. Shuman, a well-known mining engineer in California, is making plans for a canal nine miles long, which will bring water from the Mokelumne River to Mokelumne Hill, near San Andreas, Cal. Sufficient fall will be obtained to drive an electric plant, which will be erected to furnish power to the Boston and other mines in the vicinity.

A Brazilian scheme for a water-power electric plant proposes to obtain 16,000 horse power from the Tiete River and transmit it electrically to the city of Santo Paulo, 24 miles distant. The electrical energy to be developed is to be used by the Santo Paulo Tramway, Light and Power company. Contracts have already been let to United States firms for the necessary apparatus and material for the construction of the plant. Capital to the extent of $5,000,000 is required for the undertaking, and this amount is to be furnished by American and Canadian capitalists.

ELECTRICAL SECURITIES.

The Chicago Union Traction company has declared its first quarterly dividend, 1¼ per cent., on the preferred stock.

The regular quarterly dividend of three per cent. on the stock of the North Chicago Street Railroad company has been declared.

At a recent meeting the United Electric Securities company of Boston declared the regular semi-annual dividend of 3½ per cent. Walter Abbott of Boston was elected a director at the meeting in the place of Mr. Oakes A. Ames of North Easton, deceased.

The Massachusetts Electric Companies, which controls 31 street railways and several lighting companies operating in the state of Massachusetts, has declared a semi-annual dividend of two per cent. on its preferred stock, payable December 1st to stock of record November 15th. This dividend is declared out of four months' earnings, but for the semi-annual period up to October 1st.

MISCELLANEOUS.

The W. A. Fuller Electric company has filed articles of incorporation in St. Louis, Mo. The capital stock of the company is $5,000, and the stockholders are W. A. Fuller, John B. Carroll and Lee W. Grant.

A naval test at sea of the Marconi wireless-telegraph system was made on October 29th and was a complete success. Messages were sent between the New York, the Massachusetts and the lighthouse on the Highlands of Navesink, over a distance of 21 miles, without the slightest defect. The proposed experiments by the army with the Marconi system have been abandoned for the present.

It is believed in Waterbury, Conn., that a large combination of sheet brass and copper manufactories will shortly be consummated. The plants which are said to be connected with the movement are the Ansonia Brass and Copper company and Wallace & Son, both of Ansonia, Conn., the Coe Brass company of Torrington, Conn., and the Waterbury Brass company of Waterbury, Conn.

It is announced that a trust is being formed in Cleveland, O., which will include companies that control patents for illuminated signs. The companies involved will be the American Electrical company, the King's Patent Electric Bulletin company and the American Sidewalk Sign company of Cleveland, the Ohio Illuminated Sign company of Toledo and the Illuminated Sign company of Pennsylvania.

The secretary of state of West Virginia has issued a charter to the Chemical and Electrical company of New York city, for the purpose of making and dealing in chemicals, cosmetics and electrical energy of all forms. The company is capitalized at $2,000,000 and has as stockholders Albert E. Woolf, Calvin H. Allen, George W. Stockly, W. Scott Sims and Leonard B. Levake, all of New York city.

A dispatch from Kansas City, Mo., says that a combination known as the National Lead, Zinc and Spelter company, with a capitalization of $10,000,000, and with a surplus of $500,000, has been formed to control and work large interests in the Joplin-Galena district. It is said that the Joplin-Galena district now produces about seven-eighths of the zinc ore of the United States and about one-fourth of the world's supply.

TRADE NEWS.

An attachment has been issued against the Acme Electric Lamp company of New York city and a keeper put in charge. The business of the concern was started in 1896 and the present company was incorporated in 1898 with a capital of $500,000.

The Columbia Electric and Manufacturing company of Chicago reports that it has been recently increasing its facilities and has added new machine tools to its factory, so that the firm is now in a position to turn out orders on shorter notice than heretofore.

The Central Electric company, Chicago, is carrying in Chicago stock a very complete line of Edison cut-outs, sockets and receptacles. Besides the line of Edison sockets for circuits up to 110 volts, this firm also carries fiber-lined sockets for use on circuits up to 250 volts.

The Central Manufacturing company, No. 10 Central street, Boston, Mass., has been appointed New England representative for the Keystone Electric company, Erie, Pa. Mr. J. A. Desmond, formerly with the Fort Wayne Electric company, and Mr. A. G. Dyar will have charge of the territory. The line of machinery produced by the Keystone Electric company is said to cover all of the exacting requirements of the best installations.

Nearly 1,000,000 square feet of floor space is now in use in the Chicago factory and office buildings of the Western Electric company. The latest building to be added is a brick and steel, fireproof structure, fronting on Jefferson, Congress and Clinton streets. A large power house of an ultimate capacity of 3,500 horse power supplies the building with light and heat and furnishes power to the factory. An addition to the foundry and a new machine shop are soon to be added to the already large establishment. The company employs in Chicago over 4,400 hands.

BUSINESS.

The Electric Appliance company, Chicago, reports enormously increased sales of Packard lamps. It attributes this to the fact that many users of incandescent lamps are beginning to learn, by experience, that it is economy to get the best lamp obtainable, regardless of price. Its factory reports that it has just closed a contract with an eastern rapid-transit company for 70,000 lamps.

The Clonbrock Steam Boiler company, manufacturer of the Morrin-Climax boiler, announces that it has sold all the Climax boilers which it had at the Trans-Mississippi and Greater America expositions at Omaha, Neb. A 500 and a 250 horse power boiler have gone to the Omaha and Council Bluffs Railway and Bridge company of Council Bluffs, Ia., and a 250 horse power boiler to the Fort Madison Street Railway company of Fort Madison, Ia. The International Packing company of Omaha, Neb., has purchased for its new plant at Sioux City, Ia., three 500 horse power and one 200 horse power boilers.

The firm of Benjamin F. Kelley & Son, New York, has for 30 years made a specialty of studying methods of fuel saving, an outline of the results of which is given in the pages of its pamphlets. This concern has built a first-class shop and fully equipped it with machinery especially designed for its needs, and is therefore prepared to furnish feed-water heaters and boiler-feed pumps to suit all conditions, guaranteed to give the best results, and at satisfactory prices. Benjamin F. Kelley himself or his son is always on hand to look to the needs of customers at the company's office at 91 Liberty street, New York.

The enclosed type of rheostat has become a favorite type for motor starting during the last few years. In the most approved form the resistance material is in the form of a reflexed ribbon, which is embedded in sand as the filling material of a shallow box made entirely of iron or having one face of slate. A patent was issued October 24th to H. Ward Leonard, which covers the essential features of this form of rheostat box. The patent contains 28 claims, a typical one reading as follows: "In a resistance box, the combination of a box having two large parallel surfaces and a relatively narrow edge, one of the large surfaces being in the form of a cover, a resistance within the box arranged in steps or sections, terminals to which the steps or sections are connected, and a removable filling of mineral insulating material surrounding the resistance."

The India Rubber and Gutta Percha Insulating company of Yonkers, N. Y., is sending to its friends a celluloid-backed blotter that contains valuable information in tabular form relative to wire, sizes, etc. This blotter is a neat little advertising device and will, without doubt, "stick" on many a buyer's desk. Habirshaw wires and cables, however, as far as high-class service is concerned, need no better advertisement than the fact recently stated by Sales Manager J. W. Godfrey that the Cataract Construction company uses Habirshaw cables to and in the city of Buffalo for 10,000 volts. This is also the case with the power plant at Mechanicsville, N. Y., where 10,000 volts is likewise employed. Results and service, such as the instances mentioned, are thought by the company to be worthy of the consideration of thoughtful, conservative buyers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 24, 1899.

635,287. Terminal for Pole-pieces of Accumulators. Ernst Andreas, Dresden, Germany. Application filed April 11, 1899.

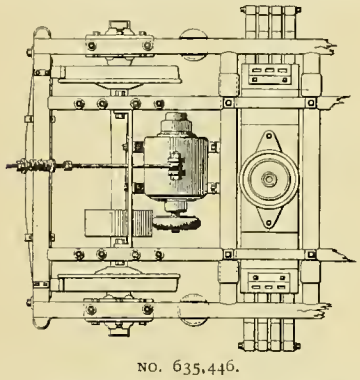
The terminal comprises a body of lead having a central bore and a recessed part forming a neck, a metallic plug piece adapted at its top to receive a connecting wire and having at its bottom a plug passing into the bore and provided at its center with an annular projection which covers the recessed portion, a perforated handle embracing the upper portion of the plug piece and secured to it, and a piece of caoutchouc tubing or similar material surrounding and connecting the principal parts, whereby a reservoir for the reception of oil is formed.

635,319. Circuit-controlling Device. John Heinze, Jr., Revere, Mass., assignor to the Simplex Electrical company, Boston, Mass. Application filed May 20, 1899.

An electric switch is described which consists of a sectional rod movable lengthwise, the two sections of the rod joined together by a spring which is normally inert, one section of the rod being the circuit-closer carrier, the other section being the actuating slide, a detent coacting with the circuit-closer carrier and adapted to restrain the latter from movement in response to movement of the slide and spring, a detent release controlled by the movement of the slide and adapted to remove the detent from coaction with the circuit-closer carrier when the actuating slide reaches an extreme position of its lengthwise movement and thus to release the spring from constraint and permit it to act on the circuit-closer carrier, and circuit terminals in position to coact with the circuit closer at one extreme of its movement.

635,353. Support for Railway-switch Operating Wires and Conduits. Frederick J. Schmeiser, Bucyrus, O. Application filed August 7, 1899.

A superstructure for the support of switch operating wires is described which combines a body formed of bard-burned clay, a top block and a bolt embracing the sides and lower end of the body and uniting the top block therewith.



NO. 635,446.

635,373. Electric Switch. Louis W. Downes, Providence, and William T. Sherman, Eden Park, R. I., assignors to the D. & W. Fuse company, Providence, R. I. Application filed January 28, 1899.

In the switch are provided a shaft rotatably mounted in suitable bearings, a switch blade movable with the shaft, contacts for the switch blade, an actuating spring coiled about and having one end secured to the shaft, an operating lever adapted by movement in opposite directions to move the other end of the spring and thereby place it under tension for rotating the shaft to open and close the switch, a detent for locking the blade in its open or closed position, and means acting on the detent to automatically release the blade when the spring has been set to a predetermined tension both in opening and closing the switch.

635,378. Coin-controlled Call-recording Device for Telephone Systems. James B. Gill, San Francisco, Cal. Application filed March 16, 1899.

One claim reads: A recording mechanism, including a rotatable record card, a marking device movable in a plane perpendicular to the card, means for projecting the marking device against the record card, means for setting the marking device for the movement, an electrically controlled releasing device in an open circuit in which is included a circuit-closing device and coin-controlled means for closing the circuit to operate the releasing device.

635,380. Electroplating Apparatus. Ransom E. Goodrich, New Britain, Conn. Application filed May 17, 1899.

In the apparatus are a tank and anodes, a receptacle, means within the tank for supporting and revolving the receptacle, a cathode conductor arranged in the receptacle, and means independent of the receptacle or its support for holding the cathode conductor in operative relation to the receptacle.

635,395. Electric Cut-out. Joseph Sachs, New York, N. Y. Application filed October 15, 1898.

A tubular case having heads within the end portions is combined with a fusible strip, and metallic terminals connected with the strip and passing across through the case and the end heads thereof, so as to hold the heads within the tubular case.

635,396. Electric Switch. Joseph Sachs, New York, N. Y. Application filed October 15, 1898.

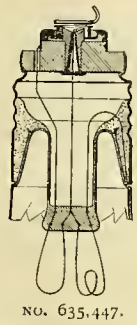
In the switch are combined stationary clips forming the circuit terminals, a safety cut-out having an in losing case and projecting terminals adapted to pass into the stationary clips, a switch body and means for removably clamping the safety cut-out to the switch body.

635,441. Resistance Box. Harry W. Leonard, New York, N. Y. Application filed November 3, 1898.

The apparatus consists of a metal box, a porcelain-enamel insulating lining for the box, a resistance in the form of a tape or ribbon in the box, the resistance being arranged in steps connected with a series of insulated contacts or binding posts, and being unattached to the box except where connected to the contacts or binding posts, a finely divided mineral insulating filling material in the box for insulating adjacent sections of the resistance from each other and for absorbing and conducting the heat from the resistance to the metal box, and a cover for the box having sealed joints.

635,446. Means for Generating Electricity from Car-wheel Axles. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting company of West Virginia. Application filed January 16, 1899.

The invention comprises a car-wheel axle, a driving pulley thereon, a cradle suspended from a truck frame having a bearing, a dynamo pivotally connected with the bearing, so as to be capable of an oscillatory motion, a pulley wheel on the armature shaft of the dynamo in frictional engagement with the driving pulley on the car-wheel axle, and a pivotal connection between the dynamo frame and car-truck frame for normally causing operative contact of the wheel on the armature shaft with the wheel on the car axle. (See cut.)



NO. 635,447.

635,447. Electric Incandescent Lamp. William J. Phelps, Elmwood, Ill. Application filed July 25, 1898.

A lamp is described which has an exhausted globe, a plurality of incandescent filaments or sections of one filament, and three or more terminals, one at least of the terminals being resilient and each of the terminals being adapted to receive current directly from a socket or support. (See cut.)

635,470. Protective or Guard Appliance. Emmerich Frischmuth, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed June 3, 1899.

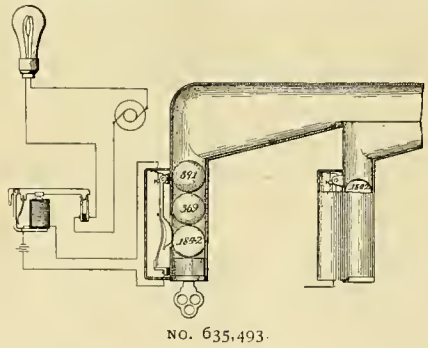
The combination with an exposed electrical conductor forming one line of a working circuit, of a guard wire grounded or connected with the opposite line of the working circuit, and spacing insulators uniting the conductors and maintaining them in close proximity to each other.

635,485. Junction Box for Electrical Conductors. Rudolf L. L. Hundhausen, Wilmersdorf, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed June 26, 1899.

In the apparatus are combined two compartments to which are led respectively the conductors of an electrical system of distribution of different polarity, a closure device normally maintaining the compartments closed, and means for securing its movement to permit of gaining access alternatively to either of the compartments.

635,489. Dynamo-electric Machine. Nicolas J. Laschet, Darmstadt, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed July 3, 1899.

Rotatable and non-rotatable members are combined with an inclosure for the members, and adjusting means movable substantially radially interposed between the inclosure and the non-rotatable member, whereby the accurate adjustment of the air-gap between the members may be readily effected.



NO. 635,493.

635,493. System of Calls and Signals. Robert J. Lonis, Chicago, Ill. Application filed April 22, 1898.

The system consists of a conduit and a missile adapted to pass through the conduit, in combination with a signal displayed at a remote point by a means set into operation by the missile. (See cut.)

635,496. Reversing Switch for Electric Motors. Ellwood V. Matlack, St. Louis, Mo. Application filed January 3, 1899.

Comprised in the switch are a base, insulator plates, two sets of "main-line" binding posts, having spring contacts, the bow springs having their inner ends located beneath the "main-line" binding posts, and their free ends formed with sockets contiguous to the spring contacts of the "main-line" binding posts, arc-receiver blocks located in the sockets, two sets of "armature" binding posts having spring contacts, two sets of "field" binding posts having spring contacts, bearing brackets, a rock shaft journaled in the brackets, two single contact arms keyed to the shaft, having sleeve extensions, and double contact arms loosely mounted on the sleeve extensions and oscillated by connection with the single contact arms.

635,506. Electric Igniter for Gas Engines. Ransom E. Olds, Lansing, Mich. Application filed April 20, 1898.

In the electric igniter are combined a fixed electrode, a longitudinally sliding electrode provided with two stops, an actuating lever, one arm of which loosely engages the electrode between the stops, a spring interposed between the lever and one of the stops, a spring urging the lever in one direction and means for actuating the lever in the other direction and suddenly releasing it.

635,515. Tablet. Morris T. Sharp, Mount Vernon, O. Application filed February 14, 1898.

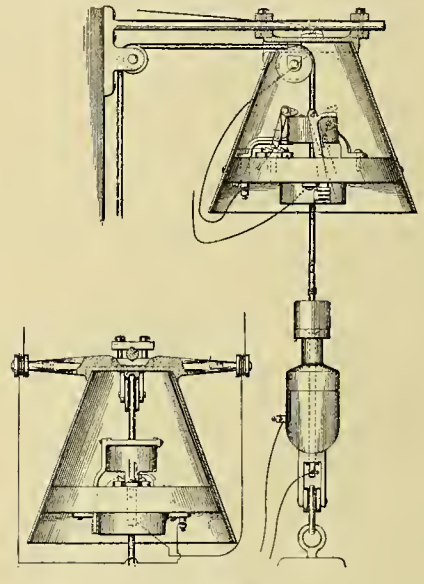
A tablet is described which has a base provided with clamping devices for engaging the side edges of a telephone-battery box top.

635,545. Electric Arc Lamp. Daniel Higham, Cambridge, Mass. Application filed April 29, 1899.

An arc lamp for direct-current constant-potential circuits is described which is provided with suitable magnetic means for maintaining the desired mean amount of current passing, in combination with independent magnetic means in the arc circuit, and a variable resistance operated upon by the independent magnetic means to effect a varying potential at the arc inversely to variations of current to meet the requirements of the arc for stability of current.

635,629. Electric Arc Lamp. Frederic S. Worsley, London, England, assignor to the British Blahnik Arc Light company, Limited, London, England. Application filed November 22, 1897.

Means are provided for regulating the feed of electric arc-lamp carbons, comprising a controlling means, a wheel, a pivoted lever connected at one end to the controlling means, and carrying at the other end a projection and a loose brake-block wedge between the wheel and the projection.



NO. 635,699.

635,637. Electrical Warp Stop-motion for Looms. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed April 10, 1899.

In the apparatus are combined with an easing device for the pile warp, having two connected supports for the warp, extending transversely of the loom and having a slot or space between them for the circuit-closing drops and the drops on the respective threads of the pile warp, terminals of the operating circuit moving with the easing device, each of the drops being adapted to close the circuit at the terminals when its supporting warp thread breaks.

635,681. Electrical Machine. James B. Hague, Horseheads, N. Y. Application filed April 28, 1899.

An electrical machine for therapeutical purposes is described comprising a platform, an insulated support mounted thereon, a cylinder having its working surface formed by a hairy pelt and mounted on the platform adjacent to the insulated support, and means for rotating the cylinder for the pelt thereof to frictionally brush a person occupying the support.

635,691. Electric Switch. Charles J. Klein, New York, N. Y., assignor to the General Incandescent Arc Light company, New York, N. Y. Application filed February 24, 1899.

There are combined in the switch circuit terminals, means for closing the circuit between the terminals, comprising a plurality of bearing surfaces, one capable of being inclined with respect to the other, a plurality of moving pieces each freely moving or sliding upon a bearing surface, and a spring connection between the moving pieces whereby an electric circuit may be opened or closed by inclining one of the bearing surfaces with respect to the other.

635,699. Arc-lamp Hanger. Glee E. McCormac and Samuel J. Lapthorne, St. Joseph, Mo., assignors to John L. Zeidler, St. Joseph, Mo. Application filed June 17, 1899.

The hanger has a stationary member provided with alined positive and negative plug seats or sockets forming line-wire terminals, a lamp-hanger supporting plunger having plugs or contacts for respective engagement with the seats or sockets, and forming lamp-wire terminals, and a hoisting cable terminally attached to the plunger and extending through the plug seats or sockets, in combination with a short-circuiting switch pivoted to one of the plug seats and adapted to engage the other plug seat during the disengagement and the initial engagement of the plugs with the seats. (See cut.)

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, NOVEMBER 11, 1899. No. 2

Citizens' Exchange at Grand Rapids.

By J. B. Ware.

The Citizens' Telephone company's exchange (Independent) at Grand Rapids, Mich., passed the 3,000 mark of telephones actually in service on October 6th. This exchange has had an interesting growth and is a good example of what may be expected, ordinarily, where reasonable rates are established under franchise regulation, and first-class service is given.

Grand Rapids is a city of 100,000 population. Previous to the organization of the Citizens' company about 1,500 telephones had been in use in the city, with rates of $50 and upward for business telephones and $40 for residences. The Citizens' company's rates are $30 and $20 respectively. Competition has reduced Bell rates to $24 and $12 for business and residence telephones, and that company has in service about 1,700 telephones, about 65 per cent. being at residence rates.

The Citizens' company was the first Independent exchange to have over 600 telephones in operation. It is located on the fourth and upper floor of the Rood block, the floor space occupied being 91 by 99 feet. The operating room, shown in the illustration, is 25 by 99 feet, extending from east to west and having windows on three sides, the south side having none. Besides being well lighted, it is properly heated and ventilated. In front of each board is an electric light dropping from the ceiling, the lamps alternating between the service of two companies, so that by no reasonable chance can the exchange be without light.

The switchboard was manufactured by the American Electric Telephone company and is of the type known as the transfer system. Each section comprises a group of three boards, two local positions, with a transfer operator's position between. The sections are arranged continuously from east to west. Each board is an oak cabinet, 22 inches in width, making 66-inch sections. The drops number from one to 2,730. Up to 1,500 there are 75 subscribers' drops to each answering operator. Above 1,500 there are 100 numbers to each board, except that above 2,500 each board has 115 drops. Thus it takes 48 operators to fill the switchboard during the day hours, not including those on the toll or state line section, which is located by itself.

Day operators work nine hours and relief operators five hours, the latter period being 1½ hours at noon and 3½ in the evening. There are 84 operators on the company's payroll. Four night operators care for the business between 10 p. m. and seven a. m., two of whom retire before midnight under ordinary circumstances. The busiest operators are those having the 75-drop boards, at least four of the boards averaging about 1,300 calls daily. Records of the calls for one day have been made at irregular intervals, and the average calls are very close to 10 for each subscriber, being an aggregate of some 28,000 connections daily at this time (October, 1899). Monday is the busiest day and Saturday forenoon the busiest half-day.

The transfers are secured by means of electric-light signals and are accurate, rapid and economical as to lamps, and the service is entirely satisfactory to the subscribers. The method of operation is as follows: Each answering operator has 12 pairs of cords and plugs, two transfer circuits to each trunk or transfer operator (thus having a possibility of four trunk circuits, which has proved ample at all times), an order circuit to each transfer operator. One plug is inserted in the calling subscriber's jack and the order taken. The second plug is inserted in the transfer jack, which automatically lights a 12-volt lamp, indicating the plug necessary for the transfer operator to use in order to complete the connection and put out the light, it being the only plug that can be used to put out that light. The transfer operator cannot listen in on the subscriber's circuit, nor can the calling subscriber hear the transfer order given. The answering operator receives the call, makes the transfer and is responsible for the connection; rings the second time, if necessary, and when the subscriber rings off makes the "disconnect" on her section. This act again lights the lamp which first gave the transfer signal and this light burns until the plug is removed by the transfer operator and is placed in its socket in its normal position, as when not in service. No "ordering off" is necessary and none is ordinarily used.

There are 20 Independent toll lines now connecting with this exchange—nine copper-metallic and 11 iron-metallic circuits. Four operators care for the toll-line business and handle about 500 completed messages in and out of Grand Rapids daily, the incoming messages being double the originating or "out" messages.

There are over 30,000 Independent telephones in the state, being about 8,000 more than the number of

CITIZENS' EXCHANGE AT GRAND RAPIDS.

the Michigan Bell company. The Citizens' company reaches three times as many toll stations within 50 miles of Grand Rapids as does the Bell company.

At present aerial cables (50 pairs) take all wires into the exchange. During the last summer 145,000 feet in ducts of underground (Camp) conduit has been completed, and 150 pairs lead cables will be drawn in as rapidly as received from the manufacturers. The most improved cable terminals will be used in the exchange for these underground cables. The terminal and cross-connecting boards now in use are home-made—strong and efficient, though not as sightly as now to be procured from the manufacturers.

In the exchange storage batteries are employed, the cells being charged with the electric current used in lighting the operating room. Three generators are used, two run by different electric-light companies and one by water power. A motor-generator is kept for day use.

The offices of the company are severely plain and on the same floor with the operating room, as are also the rooms for the operators, the shop, etc. The operators' sitting-room is 25 by 28 feet, having lockers, rocking-chairs, couches, table and pictures, etc. The operators are also provided with a dining-room (18 by 22) furnished with a gas stove, necessary dishes, knives, forks and spoons (the company also furnishes coffee, tea, sugar and milk). There is also a cloak-room and bedroom with two beds and necessary change of bedding and linen. A matron has charge of the operators' room, taking care of it and also doing the cleaning in the offices and operating-room. The shop is equipped with lathe, drill, forge and necessary tools to enable the making of all repairs and much new material by the company.

The operation and maintenance of the plant is in charge of the manager, Mr. C. E. Tarte, who is the electrician for the company—a gentleman of large experience and recognized ability. Mr. Albert Stacey is superintendent of construction, and his nearly twenty years of experience give him a rank second to few, if any, in underground and aerial construction. The secretary of the company has charge of its financial and business interests, under the direction of an executive committee and board of 12 directors.

The company built its own plant. It has no watered stock, all stock having been sold at par. The stock is held by 365 owners, over 300 being citizens of Grand Rapids. No patents are owned nor royalties paid by this company. Quarterly cash dividends of two per cent. have been paid for over two years and everything indicates that the company will continue these payments regularly, and that present rates will be maintained.

The company is fortunate in having thoroughly competent and loyal employes. Great strength results from its many stockholders, and also because of the reputation and standing in the business community of its board of directors.

New Wheel-pit at Niagara.

The Niagara Falls Power company has opened the bids for the construction of its proposed new wheel-pit and has awarded the contract to the National Contracting company of New York city. This wheel-pit will be known as wheel-pit No. 2. It will be located on the east side of the inlet canal, immediately opposite the present pit and power station. The length of the new pit will be over 400 feet, its depth will be 190 feet and its width 20 feet. It will be cut out of the solid limestone rock of the locality and lined with brick throughout, the same as the present pit.

A new power station, similar to the present station, will be erected over the new wheel-pit, and the initial installation therein will be six dynamos, and down in the pit there will be placed six 5,000 horse power turbines. This will be the initial installation, but the pit will have room for 10 turbines and the power station will have room for 10 dynamos, each of 5,000 horse power capacity, thus making the output capacity of the new pit and station 50,000 horse power, the same as the present station and pit. This will give the Niagara Falls Power company a total of 100,000 horse power, which is nearly the capacity of the tail-race facilities afforded by the tunnel. It is expected that the work will be completed in the spring of 1901.

The contracts for the new turbines and dynamos have not yet been awarded. The entire work will cost several million dollars and the power house and wheel-pit construction will give employment to hundreds of men at Niagara Falls.

The president of the National Contracting company is General Francis V. Greene. His executive ability is of the highest order, as was demonstrated in the war in the Philippines. William Young is the superintendent of the company, and like General Greene, he is a West Point graduate. The general counsel of the company is General Avery D. Andrews, the present adjutant-general of the New York State Militia. George B. Burbank, who was connected with the original tunnel construction, is one of the consulting engineers of the National Contracting company. It will be recalled that he was resident engineer of the Niagara Falls Power company during the time of the construction of the tunnel, canal and first wheel-pit. Work on the new wheel-pit will be commenced at once.

The town of Frankfort, Ind., contemplates the erection of a municipal electric-lighting plant.

Underground Conduits for Electrical Conductors.[1]

By C. H. Sewall.

In 1878 Mr. Barrett, city electrician, laid in Chicago 840 feet of two-inch wrought-iron pipe three feet below the surface of the ground. The exterior of the pipe was treated with a liberal amount of tar and linseed oil, and in it two rubber-covered wires were placed. From this date underground construction in Chicago steadily progressed. In later years important investigators of underground work were the members of the Electrical Commission of Washington, D. C. They were Professor Henry A. Rowland of the Johns Hopkins University, Lieutenant F. R. Shunk of the Engineer Corps, United States Army, and Mr. Andrew Rosewater of Omaha. After long and careful examination of the subject they reached the following conclusions:

1. In cities overhead wires are objectionable.
2. Underground wires are practicable for all kinds of electrical service.
3. Efficient cables for all kinds of electrical service can be manufactured at reasonable cost. Failures of cables heretofore have been due to inferior material, faulty construction or wrong methods of laying.
4. Conductors carrying high-potential currents may be placed close to telephone or telegraph wires without interfering by induction. To prevent accident it is well to place the high and low-potential conductors in different ducts and also to use separate manholes or compartments of manholes.
5. It is not advisable to limit the potential of current. With proper precautions currents of the highest potentials may be safely used.
6. Efficient management of electrical matters requires a permanent bureau or department, such as exists in Chicago or Philadelphia.
7. A single subway in the middle of the street is impracticable: (a) Because of its excessive cost; (b) because it requires connections under the streets to the property lines and so does not do away with the cutting up and repairing of streets.

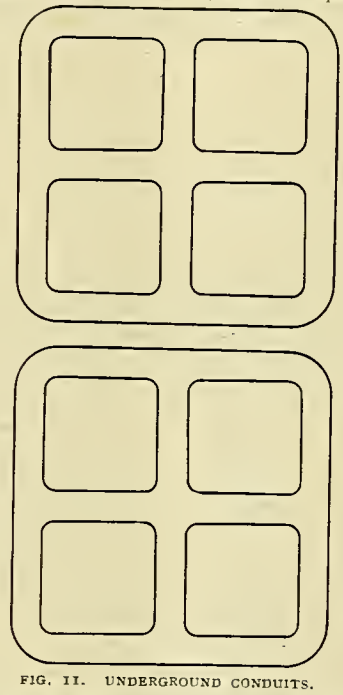


FIG. 11. UNDERGROUND CONDUITS.

Where water, gas and sewer pipes are yet to be laid a double subway might be practicable; that is, a tunnel on each side of the street under the sidewalk.

Where electrical wires alone are to be accommodated a system of conduit ducts and manholes on the "drawing-in" plan is preferable.

8. As regards the ownership of the conduits we believe the public interests are best subserved by public ownership.

In 1896 an electric commission in the city of Baltimore issued an exhaustive report on a general subway system for that city. The engineer of the commission recommended the adoption of the "drawing-in" system, of a central blower and compressed air; and to build the conduit system at least 50 per cent. larger in capacity than required by present service. He recommended the consideration of only four forms of conduit—the cement-lined conduit, wrought-iron pipe, Camp terra-cotta conduit and McRoy terra-cotta conduit. He describes the cement-lined as being eight feet in length and having an outer sheet-iron shell lined with fine cement mortar, five-eighths inch in thickness, with cast-iron male and female rings fitted at either end. It was specified that the pipes be spaced both vertically and horizontally 5¾ inches on centers, the spaces between pipes being filled with concrete. The wrought-iron pipe was to be treated, while hot, with asphaltum inside and out. This was also to be spaced 5¾ inches on centers and the spaces filled with concrete. (Fig. 12.)

Camp terra-cotta conduit is described as being composed of vitrified clay, the inner and outer surfaces being salt glazed. It was specified that the tiles should be spaced both vertically and horizontally one-quarter inch apart and spaces filled with cement mortar. (Fig. 13.)

The McRoy product is described as terra-cotta conduit made in multiple-duct form, of any desired number, from two to 12 ducts, and in sections from four to six feet long. The material used in its manufacture is shale finely ground and the sections are glazed inside and out. It was specified that the tiles of any size or number of ducts should be spaced one-quarter inch vertically and horizontally apart and the spaces filled with cement mortar. (Fig. 11.)

All of the different kinds of conduit pipe were to be laid in groups upon a bed of concrete six inches thick, and their side walls and tops were also to be six inches of concrete.

In addition to the four types of conduit first described, there are used wood pipes and pipes of cement concrete, without the sheet-iron lining.

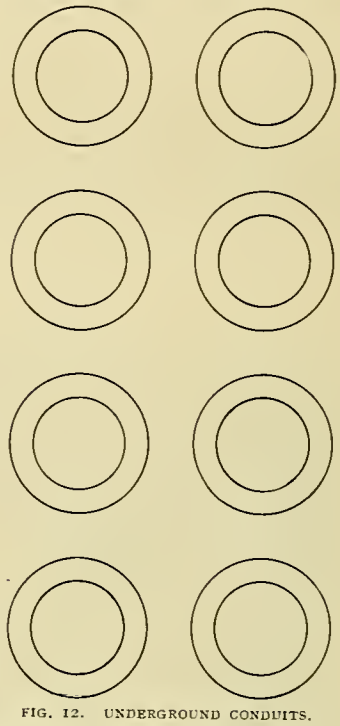


FIG. 12. UNDERGROUND CONDUITS.

This audience is undoubtedly familiar with what is called pump log (wood pipe), but to make the record complete, I will state that it is a square joist six to eight feet long, five by five inches square cross-section, through which a hole, generally three inches diameter, is bored lengthwise of the joist. There is also provided tenon-and-socket joints to fit the pipes together. When used as a conduit the wood is sometimes in the usual condition of seasoned lumber and sometimes treated with a dead oil of coal tar.

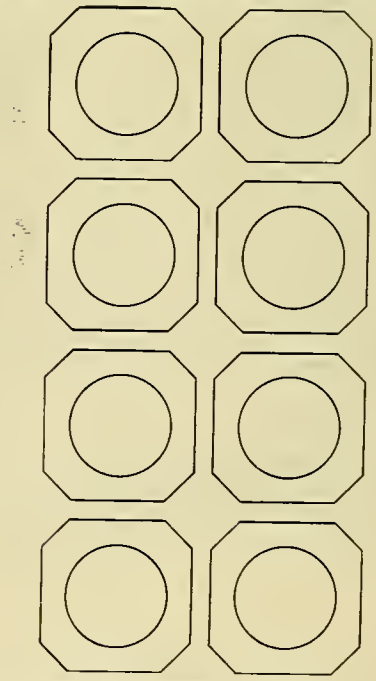


FIG. 13. UNDERGROUND CONDUITS.

All conduits in general use are typified by the ones just described.

It is the further purpose of this paper to place before you in detail the requirements in underground construction and then suggest measures for meeting them.

It has come to be the universal custom to protect conductors or groups of conductors with a lead sheath. So far as can be foreseen this practice will continue indefinitely. It is also a universal practice to draw them into ducts, and consequently the conduit problem is to find the best receptacle for

1. Read before the Chicago Electrical association, October 6, 1899.

lead pipe after the cable is in place and one into which lead pipe may be drawn without injury.

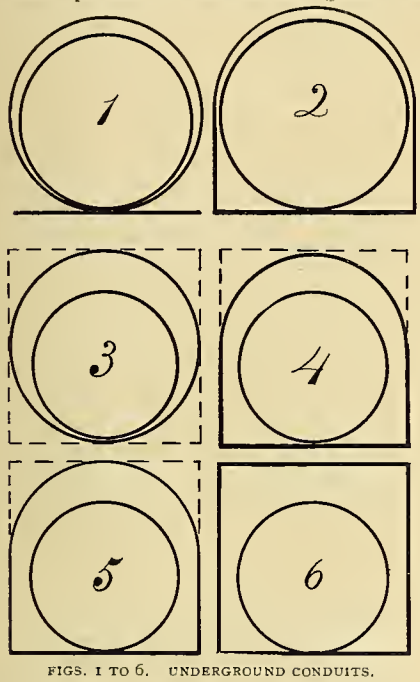
Good engineers absolutely forbid any changes of level that cause basin-like depressions, for such make a water pocket, and, in fact, a cesspool. If the water freezes, as has often happened, the cable is smashed; if the water should not freeze the contents of a cesspool are unfavorable to the preservation of lead pipe.

A rising curve or hump will form a gas pocket, the disadvantage of which is obvious.

It is good practice to have the entrance of the duct to the manhole at one end of a section several inches lower than that at the other, for the purpose of drainage; but the decline should be perfectly continuous. Whenever it is necessary, from existing conditions, to change levels considerably between planned sections, a new manhole is introduced, making the original one section into two.

The cable should be subjected, in drawing in, to as little strain as possible. If it does not wedge (a condition which will presently be discussed), the strain will be proportional to the weight of the cable and the nature of the surfaces in contact. A section of cable 500 feet long and weighing six pounds per foot is not unusual. It can be coated with grease as it enters the duct. It is probable the strain over a rough, uneven floor is three or four times as great as it would be over a polished and even one.

If large water pockets and cesspools and large gas pockets are bad features, it would seem that small ones might prove proportionally so. Now none of the conduits in general use to-day are accurate in alignment, nor are the surfaces of the duct interiors free from roughness; and one of the problems presented to the conduit engineer is the



FIGS. 1 TO 6. UNDERGROUND CONDUITS.

attainment of absolutely good results in these respects.

Lateral curves are occasionally necessary and the requirements of a curved duct are that the curve shall be regular and have a polished (i. e., non-frictional) surface.

With the level and smooth duct interior, we must also consider the durability of the material of which the conduit is made, its strength, its form and the form of the duct opening; the space it requires and its cost in money.

For some years the writer has been trying to devise a perfect conduit, and the results so far attained may prove more interesting than a recital of specifications.

First, as to material, it was decided that Portland-cement concrete was best. Terra-cotta does not shrink evenly in baking; if vitrified, warping is still more evident. In order to make long pipes vitrifaction must be neglected. Without thorough vitrifaction there is danger of future decay. Wood untreated is known to decay. Treatment with the dead oil of coal tar seems to preserve it, but there is a suspicion that the compound may be only sleeping, and should it awaken the lead pipe will suffer severely. Concrete ducts have been in use for many years with good results. If concrete is good for the outside, as seems to be now the universal opinion, then it should be good for the inside. There seems to be nothing else so sure to resist corrosive influences. Now as to the form of the ducts. There were in use at the time experimenting began round ducts and square ones. The round duct (the ducts having the same height and width) leaves the structure stronger than the square one, for the reason that it sacrifices less material. On the other hand, the cable, other things being equal, will pull easier in the square form, as it will lie along the ducts more or less bent and will straighten under strain in the square one, with less chance of rubbing against the side walls. Looking at Fig. 3, a projection on the lower right-hand quarter at one point and another at the lower left-hand quarter at another point will make a wedge. With such a condition existing on the cable as shown in Fig. 1 progress would probably be impossible. There was adopted a compromise form by retaining the vertical walls of the square duct and filling up the upper corners (Fig. 2), gaining material and the arch form, which makes the duct itself stronger. The rule further adopted was that the form of duct should be such that the height of each vertical side should be exactly the same length as the radius of the semi-circle which surmounted them. Looking at Figs. 7, 8 and 9, you will see the reason for the rule.

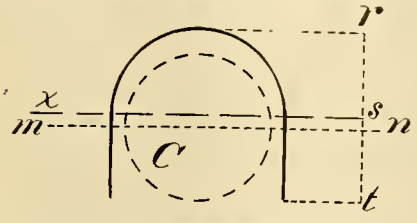


FIG. 7. UNDERGROUND CONDUITS.

There must necessarily be clearance between the cable and the duct. In Fig. 7 the greatest chord (the diameter) through the circle (C) is at the line (m n), which must be always below the line (x s) where the surmounting semi-circle begins; consequently the cable will always get its full chance to straighten and to swing. Figs. 8 and 9 show the loss of space if the arch duct varies from the rule just given by being made either higher or wider.

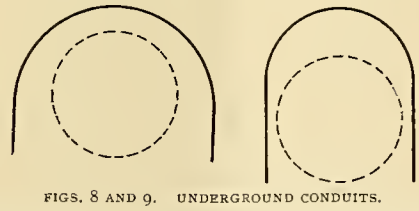
Figs. 3, 4, 5 and 6 demonstrate that there is no difference in the space occupied by a square, or round or arched duct.

As to the strength of the structure as affected by the duct: Undoubtedly a round wrought-iron pipe contributes more strength than any other. Not only on account of its own material, but because it displaces less concrete; but iron pipe is expensive and liable to corrode on its inside surface. Now, it is certain that the structural concrete sets to a concrete shell, making the mass integral, and this gives the concrete shell a decided advantage over the pipe with sheet-iron covering or a glazed-clay pipe, which certainly do not set to the filling concrete; but it is also true that there is a difference in the elastic limits of the shell and the filling concrete. These facts led to the conclusion that the shell of the arch should be as thin as possible, and three-sixteenths inch is thought to be the proper thickness. With a wire cloth imbedded just within the outside surface it is known to be; but it is hoped that the wire cloth may be eliminated.

Rude machinery has been constructed experimentally to manufacture these arches and has fulfilled every expectation. It will not only make the arch but polish its interior.

The arch, you will understand, is made without any bottom and absolutely accurate in dimensions. The lengths are placed end to end upon a floor which is made by hand in the trench and polished by hand. There is no joint whatever in the duct floor; and, with the exception of the arch lengths, the whole mass is continuous from manhole to manhole. Where the arch lengths join a reinforcement of wire cloth is placed over the abutting ends, making the joint fully as strong as any other part of the arch, so that there is not lost the strength of even that three-sixteenths inch of concrete.

The money expense is inconsiderable. The cost of cement in the arch foot of three inches is less than one-third of one cent per foot. Wire cloth is not expensive, but it is thought even that may be eliminated. Manufacturing by machinery, in large quantities, will make the cost of labor very little. When the experiments are completed we should have a conduit of material absolutely proof against



FIGS. 8 AND 9. UNDERGROUND CONDUITS.

corrosion, a structure absolutely accurate in alignment and with a polished interior free from even the smallest holes or pockets, stronger than any other combination now in use except wrought-iron pipe; and, without exception, made at less cost.

As to future development of underground construction, the writer believes the quantity of conduit laid will be enormous. One curious fact in this connection is the compression in space that is going on in lead-covered cables. It is possible to-day to put 200 pairs (400 single telephone wires) within a lead sheath whose outside diameter is less than 1½ inches. There is, it is true, an increase of copper resistance and an increase of static capacity over the old forms, but the loss of electrical conditions in those respects is by no means serious.

In the transmission of electric power there have recently been constructed cables carrying, under one sheath, three wires of No. 0000 cross-section, to withstand a working pressure of 11,000 volts alternating current (three-phase), the outside diameter of the cable being only a trifle over two inches. The standard for conduit ducts has been an inside diameter of three inches, but it is likely soon to change to two inches.

Fig. 10 shows the cross-sectional appearance of a conduit made with concrete arches. Fig. 11 shows a conduit of multiple-clay duct, with a border of four inches of structural concrete; Fig. 12, cement pipes, with or without sheet-iron covering, and four inches of border; Fig. 13, the single terra-cotta pipes, of which the Camp is the prominent type.

Pollak-Virag Telegraph System to Be Tested in Chicago.

A test of the Pollak-Virag automatic-telegraph system is soon to be made in Chicago, under the supervision of the Guardian Trust company, which is said to have acquired all American rights to the invention. A test was recently made in Europe of the new system over a 700-mile line between Budapest and Berlin. At this test C. M. Baker, superintendent of construction of the Postal Telegraph-cable company in Chicago, was present with L. O. McPherson, a former associate with Elisha Gray. Mr. Baker attended the test in the interests of the Guardian Trust company and not the Postal company, and Mr. McPherson acted as electrical expert. Although the Budapest-Berlin tests were made under adverse circumstances, during a heavy storm, the results were so satisfactory to Mr. Baker and the capitalists who are backing the American enterprise that it was arranged that there should be a

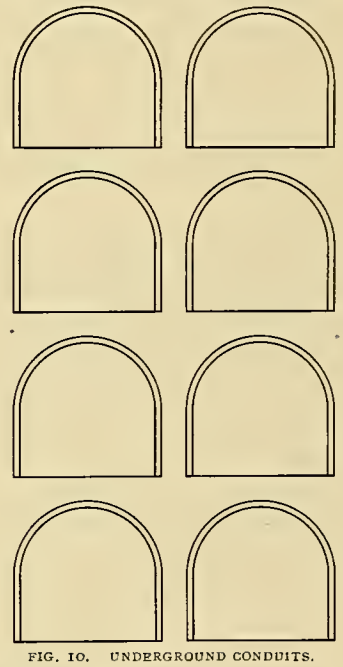


FIG. 10. UNDERGROUND CONDUITS.

complete test of the instruments in Chicago. Messrs. Pollak and Virag, the inventors of the new system, sailed from Hamburg on October 29th, en route for Chicago, with instruments and material for a series of tests. These gentlemen on their arrival will proceed at once to make arrangements for the trials, which will probably be made between November 10th and 15th. The tests will be made over a line between Chicago and some large city 500 to 1,000 miles distant. New York will probably be the other city chosen if a free wire can be obtained. Mr. Baker will have immediate supervision of the trials, and if they result as successfully as is expected a new company will be formed with a large capital to exploit the invention.

Fire at American Steel and Wire Plant.

Seven of the buildings belonging to the plant of the American Steel and Wire company at Waukegan, Ill., and formerly known as the Washburn & Moen plant, were damaged by fire on November 4th. The buildings burned were the wire mill, the galvanizing shop, the tinning room, the muffle house, the cleaning house, the engine room and the electric-light plant. About 800 men were employed in the plant, 500 being engaged in the part destroyed. The origin of the fire is not definitely known. It is estimated the loss to the company will approximate $500,000, with $314,000 insurance. In all probability the plant will be immediately rebuilt.

The fire affected particularly the finishing end of the plant, the rolling mill not being damaged in any respect. The warehouse, with a fair stock of goods, was also saved. Arrangements have already been made by the company for the execution, by its other plants, of unfilled orders now placed with the Waukegan plant, so that the fire will not seriously delay its business.

Moving Troops on Trolley Cars.

The new Forty-second Regiment, U. S. V., left Fort Niagara, N. Y., on Monday, October 30th, for San Francisco, from which port the men will sail for the Philippines. Fort Niagara is located at the mouth of the Niagara River, 12 miles from Niagara Falls and seven miles below Lewiston. It is in the village of Youngstown, and at this season of year the only means of communication with the outside towns is by means of the Lewiston and Youngstown Frontier railway, the electric road that connects the villages of Lewiston and Youngstown, the route lying through the orchard section below the Lewiston Mountain. During the time the regiment was being organized at Fort Niagara the business of the "Old Fort Route," as the line is popularly styled, was very much increased, both in the passenger and freight service. There was the carrying of the men of the regiment to and fro, and also the travel of visitors to the post to view the sight of the city of tents.

On the day that the regiment left the fort Manager Lott of the "Old Fort Route" arranged to carry them to Lewiston in a train of trolley cars, a single battalion moving at a time. This trolley train consisted of 11 passenger cars and a special motor car. The picture herewith presented shows the second battalion on the cars. The tracks of the "Old Fort Route" run into the government grounds at Fort Niagara, making it very convenient to load the troops. The scene presented in the illustration shows the train emerging from the woods about the fort. The people of the vicinity of the fort were very early astir, and the departure of the regiment was the occasion of the display of much patriotism. Flags and bunting waved in profusion, and at points along the trolley line ladies filled baskets with apples, which were put aboard

MOVING TROOPS ON TROLLEY CARS.

the cars for the soldiers. The electric-railway company handled the 1,400 men in fine style. In addition to the regiment, it carried over 300,000 pounds of freight for the regiment, and this was loaded in freight cars at the lower end of the electric road and then run up to Lewiston, where it was turned over to the New York Central. There were also over five cars of excess baggage handled on the trolley line. At Lewiston the soldiers boarded special trains on the New York Central, in which they were carried to Niagara Falls, where they were transferred to sleeping coaches, in which they traveled to San Francisco. The Forty-second Regiment is said to be the finest volunteer regiment yet sent to the Philippines by the United States. Every state in the Union, excepting Delaware, is represented in it, and seven-eighths of the men have seen service, although among the privates there is hardly a man over 30 years old. In fact, one of the soldiers stated that none of the privates is over 30. Before its departure the regiment was presented with a beautiful flag by the people of Niagara Falls, and this flag will be carried in battle.

A company has been incorporated, under the name of the Columbus, Newark and Buckeye Park Traction company, with a capital stock of $100,000, to construct an electric railway from Columbus to Newark, O., with a spur running to the Licking reservoir, where it is proposed to establish a park and summer resort. The incorporators are A. J. Warner of Marietta, W. R. Pomerene, M. O. Baker and J. P. Carlisle of Coshocton, and Matthew Spellacy of Columbus. The company has succeeded to all the rights, franchises and privileges of the Columbus and Buckeye Street Railway company, which was incorporated nearly two years ago, and has applied to the City Council of Columbus for a franchise to enter that city.

Determination of Volt and Ampere Capacities.

By Alton D. Adams.

Electrical machinery has come into such general use that repair shops and dealers are often called on to handle and connect dynamos and motors of uncertain character. In any of these transactions it is necessary to know both the capacity and voltage of the machine in question. Unlike the steam engine, the electric machine does not depend directly for its capacity on dimensions that can be taken with a two-foot rule, and its voltage, to an ordinary observer, is an entirely unknown quantity. The practice with manufacturers has been to mark dynamos and motors with arbitrary letters and figures, understood at the shop, but meaningless to outsiders. Sometimes either the ampere capacity or the voltage of a machine is omitted. Such information as was thought proper has commonly been given on small name plates lightly attached to dynamo and motor frames with small screws. These name plates have not infrequently been removed by contractors and repair men for purposes best known to themselves, so that a subsequent purchaser of a machine finds it a very uncertain quantity.

A result of these conditions is that dynamos and motors frequently come to those who must handle or install them without marks to indicate the pressure at which they are designed to operate or their working capacity.

The variety of designs and the great variation in speeds common with the several makers of electrical machines contribute to the uncertainty in any particular case, as it is not uncommon to find two motors of the same weight whose horse-power capacities vary by as much as 100 per cent. While the capacity and working conditions of a dynamo or motor are not so evident from a very few of the main dimensions as in the steam engine or boiler, they are, none the less, inherent in the several parts, and the ability to determine them renders one independent of name plates.

The working capacity of any electrical machine, whether used as dynamo or motor, and either use is possible in any case, depends on the electrical pressure or voltage at which the machine operates and the amperes of current that may properly flow through it. The product of volts and amperes gives the rate of work in watts, which can be reduced to horse power by using the factor 746 as a divisor. If the machine in question is to be used as a dynamo the horse power of electrical output, as obtained above, should be divided by from .8 to .9 to find the mechanical power necessary to drive it. If motor service is required the electrical horse power, found as above, should be multiplied by from .8 to .9 to find the mechanical power that may be safely delivered at the motor pulley, gear or coupling. It will not do to start a motor or dynamo and put on load "to see what it will give," as is sometimes suggested, since an electrical machine does not slow up or give much outward sign when overloaded, as does an engine, but its windings continue to rise in temperature until the cotton insulation, on which they depend for working qualities, is destroyed. The ampere capacity of a dynamo or motor depends directly on the area of contact between the brushes and commutator, and also, on the resistance of the armature winding, which latter depends again on the size of wire used in the coils.

The current capacity of a given machine should be determined for the commutator and armature winding separately, the results compared, and the smaller used as the true amount, on the principle that a chain is no stronger than its weakest link.

Having found the total area of brush contact on the commutator, this area should be divided by two, because the current enters the commutator at one-half of the total number of brushes and goes out at the other half. Taking half the total area of brush contact as that which must conduct the total current permissible, the current capacity is found by allowing about 30 amperes per square inch of contact for carbon brushes and 100 amperes per square inch of contact for copper gauze or leaf brushes. Electrical machines of good make are usually supplied with brushes of the proper dimensions at the start, but they are sometimes lacking at later periods, or others may have been substituted. The proper brush-contact area offered by a given commutator may be readily calculated from the width and length of one bar and the number of points about the commutator at which brushes are to be applied.

In dynamos and motors of ordinary design the width of a carbon-brush contact may be safely made twice that of a single commutator bar. From one to 1½ inches in length on the commutator surface should be left for space between brushes and for end play of the armature. The actual brush-contact surface at any one point on the commutator is the product of twice the width of one bar or segment into its length, minus one inch; as square inches brush surface = 2 (width of one segment) × (length of segment — 1). If the machine has but two sets of brushes, as is the case in all bipolar and some multipolar dynamos and motors, the contact areas of one set will give the current capacity of the commutator. In most multipolar machines there is a set of brushes for each pole, and one-half the total number will decide the current capacity.

To determine the current capacity of armature windings it is necessary to find their electrical resistance in ohms, or else their sectional area. When accurate volt and ammeters are available, together with a source of electric current, the easiest way to find the armature resistance is to send a known current through the armature with all brushes in position, and measure the volts between adjacent sets of brushes while the current is passing.

Volt and ammeters for this purpose should be graduated at least to tenths. Care should be taken to have the contact of brushes on the commutator as perfect as possible. A skilled electrical workman is required to make this test, and he should not allow the current to pass through the armature during more than two or three minutes at a time unless very sure that the current flowing is not greater than that for which the armature is intended. It is well to calculate the current capacity of the armature from the commutator dimensions at the start, as above outlined, and then use one-half to the full number of amperes so found to make the resistance test. Having found the drop in volts between the brushes, as above, the resistance of the armature can be found by the formula, volts÷amperes=ohms.

The ohms resistance of the armature once known, the rate at which heat is generated in its windings with any given number of amperes flowing through them is readily obtained by the formula, watts=(amperes)^2 × ohms. The heat that may be safely developed in a given armature per unit of time depends on the surface exposed to the air, and may be safely taken for the windings alone at one watt per square inch of outside armature surface.

To find this armature surface with sufficient accuracy for present purposes consider each end of the armature a plain disc and to their combined areas in square inches add that of the cylindrical part of the armature. The area in square inches of armature surface thus found is multiplied by the watt loss allowable per square inch to get the total allowable loss in windings per second in watts. This allowable watt loss, divided by the armature resistance in ohms, gives the square of the proper current in amperes. The machine should be worked at first with not more than the amperes found for either the commutator or windings, and after two or three hours' run the armature should be stopped and tested with a thermometer for rise in temperature, which should not in any case exceed 50° C. or 90° F. above the surrounding air. If the temperature rise on the above test is greater than the limit named, the amperes flowing through the armature should be reduced and other tests for temperature rise made until a current capacity is fixed on that will not exceed the temperature limit on a continuous run of 10 hours. If, on the first test, the temperature rise is below the limit, the run should be continued for another hour or two and the heat test again made, and so on until it is certain that the safe limit of temperature rise above the surrounding air will not be exceeded.

The time during which an electrical machine will attain its maximum temperature above the surrounding air when under continuous operation at full load varies with the size and construction. Small machines usually become as hot as they will get at a given outside temperature, during three or four hours' run at full load, while, as the size of machines increases, the time becomes longer during which they must be operated at full load to attain their maximum rise above the air. A run of 10 hours at full load will be found enough, however, for most machines of moderate size in common use to attain their maximum rise. If the instruments and current supply are not at hand to make the above test for armature resistance, or no one present

is able to conduct it, the approximate current capacity of an armature may be determined from the sectional area of its coils, and in many cases this will prove the more ready method.

On examination it will be found that two armature wires or conductors are connected to each commutator bar and that those conductors are of equal size. The sectional area of one of the armature wires or conductors should be determined by actual measurement with a micrometer, and if the dynamo or motor is bipolar, or has but two sets of brushes, even though multipolar, the sectional area of the armature winding is the sum of the areas of the two conductors entering one segment. If the machine is multipolar the sum of the sectional areas of the two wires entering one segment must be multiplied by half the number of sets of brushes to get the effective area of armature conductors. Thus, in a four-pole machine, with four sets of brushes, the area of conductors to one segment should be multiplied by two. An exception to this rule for multipolar machines is found when their armatures are what are known as series wound, in which case the effective area of armature conductors is that of the two wires entering one segment. As series-wound multipolar armatures are rarely provided with more than two sets of brushes, the exception just noted is of small practical moment.

Having found the effective area of armature coils, as above, the approximate current capacity of the armature can be determined by an allowance of 2,000 amperes per square inch of cross-section, which is an average value for ampere density per square inch in the armature coils of well-built dynamos and motors.

After an armature has been operated for two or three hours with the current indicated by the cross-section of its coils, the tests for rise of temperature should be made as above outlined, and the work done by the machine increased or diminished as the safe-heating limit dictates.

There is another condition besides that of temperature rise that determines the current capacity of a dynamo or motor; that is, the sparking at the brushes. In well-designed machines, however, the point of load at which sparking becomes serious is put considerably beyond the heating limit, so that a load that would cause a destructive rise in temperature if carried during 10 hours might not cause any very serious sparking at the brushes. In case of very heavy overloads, however, the sparking gives the first indication of trouble, as it begins at once, while the rise in temperature is gradual.

The current capacity alone gives no information as to the working capacity of a dynamo or motor, since the watts, or rate of work, are the product of amperes and volts. A machine for 100 amperes may therefore be of one horse power output for electroplating at 7½ volts, of 80 horse power output at 600 volts for railway work. As an armature for one speed and voltage may be wound the same as another armature for a different speed and voltage, it is impossible to determine from an armature alone for what voltage the machine to which it belongs is intended. As nearly all machines in general use for electric light, power and electro-chemical purposes have a shunt magnet winding that is intended to receive the full line pressure, the volts may be determined from this winding. The electric pressures in common use for electric light and power are about 125, 250 and 500 to 600 volts, and are thus so far apart in amount that shunt-magnet coils are quite readily determined as to voltage. The first step to decide on the voltage for which shunt coils are intended is to determine their resistance in ohms, from which the watts expended in the coils when connected to any given pressure may be readily computed from the formula, $\text{watts} = \frac{(\text{volts})^2}{\text{ohms}}$, which gives the watts expended in the coils for a given pressure in volts.

The resistance in ohms of the magnet coils can be measured with enough accuracy for present purposes by a method similar to that described for measuring armature resistance, but as there is no guide to the true current capacity of the coils, it is best to employ only the lowest pressure in common use to supply current for the test, that is, about 125 volts. As 125-volt coils would take about four times their proper amount of energy if connected to a 250-volt supply, and about 16 times if connected to a 500-volt supply, the danger of overheating when coils of unknown capacity are connected to any pressure above 125 volts is obvious.

When coils for the higher pressures are connected to 125-volt service they receive much less than their normal amperes, and are thus safe from harm. If it is not convenient to measure the resistance of the shunt magnet coils, the diameter of the wire composing them should be measured with the micrometer and the coils weighed. The common printed tables of copper wire give the weight of each diameter per 1,000 feet, and this weight divided into the total gives the complete length of wire in the shunt. Knowing the length and diameter of a copper wire, its resistance may be found by the use of wire tables, or may be computed from the formula, $\frac{\text{length in feet} \times 10.7}{(\text{diameter in mils})^2} = \text{ohms}$, in which 10.7 is the resistance in ohms of a copper wire one foot long and .001 inch in diameter.

Since the shunt coils consume energy, they rise in temperature above the surrounding air, as does the armature, and this rise is limited by the exposed surface of the coils which radiates heat. To find approximately the amount of heat the coils can dispose of per second their outside dimensions should be taken and the square inches of exposed surface computed. It has been found by experience that magnet coils, insulated in the usual way, can safely dispose of heat energy at the rate of about .75 watt per square inch of coil surface exposed to the open air, so that when the surface of any particular coils is known in square inches it is easy to compute the permissible watts allowable in the coils. Knowing from the ohms of resistance the rate at which each electric pressure will cause heat to be developed in the coil, it becomes at once evident at which voltage the coils should be operated, and this is the voltage at which the machine should be operated.

The simple observations and computations noted above, if put to use will often do away with uncertainty concerning the proper use of electrical machinery and prevent costly burn-outs from overheated windings.

Large Electric Lift at Weehawken.

An inclined railway so steep that it might almost be styled an elevator is building at the Weehawken Bluffs, on the Jersey shore of the Hudson, near New York. On the lower level a concrete base, 50 feet square, is designed to support the steel girders which will sustain the incline till the upper platform is reached. The gradient will be a rise of 72 feet in every 100 feet horizontal, making the steepest incline on which cars are operated in the world. The width of the sunken path is 46 feet, and the cars to move within its walls will completely fill it, being each 23 feet wide. The cars will weigh 20 tons each, and will have a capacity of more than 20 tons. The elevators will be triangular in form, the shorter of the sides being formed by the supports necessary to maintain a level floor. They will each be operated by three cables, one of which will be in reserve as a safety precaution. An automatic brake will operate in connection with the safety cable, insuring immunity from accident, it is said. The cars will move independently of one another, contrary to former methods on inclined-plane roads, where one car is used to balance the other while moving in opposite directions. The cars of the Weehawken elevator will not be mutually dependent, but may rise together, if occasion demands it. Beneath the upper platform will revolve the large cable-driving pulley, operated by electricity from the new power plant of the North Hudson electric line, three blocks to the south.

The cars on this inclined railway will sink into the concrete base so that the floor will be aligned with the surface of the lower road. Thus trolley cars will be enabled to board the elevators by means of the tracks laid in their floors, without disturbing their passengers. One elevator will be used for cars and the other for pedestrians and teams. The cars will ascend to a point where they will be on a level with the surface of the bluff. Automatic track attachments will hold the car at this point until the trolley cars and passengers have landed. The toll for the upward trip will be twice as large as for the downward one.

Atlanta, Ind., is talking of putting in an electric-light plant.

French Electric Railroad with Steep Grades.

In Laon, France, there is a miniature specimen of an electric railroad with an extreme length of 1,479 meters. Its rolling stock comprises three cars. There are some items of unusual interest connected with the enterprise. The line of the road is one of decided curves and grades. The town, which is the capital of the department of Aisne, 14 miles northeast of Paris, is perched on an isolated hill,

FIG. 1. FRENCH ELECTRIC RAILROAD WITH STEEP GRADES.—CAR ON INCLINED VIADUCT.

and the line of railway lies along the steep incline. The summit of the road has an altitude of 181.57 meters, while the lower level is only 83.85 meters. The difference in the altitudes is therefore nearly 100 meters in a run of 1,200 meters, or a grade of 81 millimeters to the meter. This is the average grade, but for nearly half this distance the grades are insignificant. There is for the other portion—about 860 meters—a grade of 10 per cent., or 100 millimeters to the meter, and in a short run of 202 meters the rise is 130 millimeters to the meter.

The most important piece of engineering along the route of this bijou railway is the viaduct (Fig. 1), which has an incline of 122 millimeters to the meter and has a length of 80 meters. There is also a tunnel 50 meters in length. The entrance to the tunnel is shown in Fig. 2.

While a rack-and-cog combination is available in case of necessity for holding the cars from slipping,

FIG. 2. FRENCH ELECTRIC RAILROAD WITH STEEP GRADES.—ENTRANCE TO TUNNEL.

it is seldom or never used, the traction being found sufficient to maintain hold on the rail under all ordinary conditions.

On the trial trips, on July 9th last, after a cautious test run of 12 minutes between the terminals—the city hall and the depot—the run was then made in 6.5 minutes, without the aid of the cogs, up the grade. This is claimed to be the first successful attempt at climbing so sharp a grade by mere traction.

The track is one meter in width, and the cars contain seats for 26 persons—nine first and 17 second-class. Each car has an apartment for packages, baggage, etc., while the platforms can accommodate a number of standing passengers. Each car, says l'Electricien, is equipped with two "G E 53" motors, supplied by currents from dynamos of 1,200 amperes' capacity, at 120 volts.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new, should be given.

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There seems to be a possibility that Logansport, Ind., may try the experiment of purchasing and operating the Independent telephone plant in that city. It is said that the City Council is seriously contemplating such action, that the plant may not fall into the possession of the Bell company. This is one of the latest developments of the municipal-ownership idea, and its practicability and utility are very doubtful, even though the motive of averting the reversion to monopoly is a good one. Private ownership is doing very well against the Bell monopoly, or former monopoly, and it seems the part of wisdom to give it a fair and thorough trial before resorting to state control. And it must be borne in mind that if the theory of government control is correct, municipal ownership will be only a temporary makeshift at best, for the telephone industry of to-day, like the telegraph, must be handled either by private owners or by the federal government, surveying the whole country.

In his annual report Brigadier-general A. W. Greely, chief signal officer of the United States Army, heartily commends the project of an American trans-Pacific cable, as might be expected. He says that such a cable is "essential," in order to join closer together the United States and the new Pacific dependencies. General Greely also suggests that an international cable conference be called to consider the whole subject of the rights of cable property in time of war. The idea is a good one, although it has been broached before without practical effect. Great Britain, with its preponderant cable interests, might well take the initiative in requesting the favorable attention of the powers to some plan for holding such a congress. The South African Republic, with which England is now at war, is not a maritime state; but if it were, or if the British had any sea-going nation as their adversary, the cutting of the cables would be one of the most effective methods possible for crippling the resources of the British emplire. The status of international cables in time of war should be definitely settled, because it is usually the case that outside nations have interests that are involved by the cutting or exclusive use of cables by one of the combatants. Of course it is doubtful whether any agreement could be reached that would hold in the stress of war between two great nations, but, at any rate, an effort should be made to reach some conclusion.

Mr. Monaghan, the American consul at Chemnitz, in Germany, is an enthusiastic believer in the possibilities of American trade in Russia. "The field open to us is enormous," he says. "Russia will want for a long time the same kinds of tools, implements and machines as we have used. It has mines to open, oil fields to drain or exploit, forests to cut down, mills to build, roads, railroads and bridges to construct. All kinds of time and labor-saving machines will be wanted. One ounce of effort put into Russia will yield better results than tons in Germany and other parts of this old continent. Germany, Belgium, France, England—all of them—are aiming for the same goal—a foothold in Russia. An effort now, before the important parts are all taken, will pay much better than later on. The disposition of Russia toward our people is very favorable." The consul says that the best way to get business in Russia, as at home, is to send a man after it. Long credits must be given—six to 12 months—and the fluctuations of foreign exchange must be considered. Packing is a very important factor. Catalogues, if sent at all, must give prices and be printed in Russian or, less preferably, French. Weights and dimensions should be stated in metric measurements. Mr. Monoghan believes that "hustle has more to do with success in business than has almost any other factor." He thinks that advertising will pay export as well as domestic traders, and, in short, recommends modern American business methods for use in Russia.

Our old friend, the "deadly trolley," seems to have gone out of business. The expression is now seldom heard, even in the New York sensational press. Enters instead the pleasing prospect of "death by fire in mid-air." A correspondent of the New York Sun professes to have a well-founded horror that this dreadful fate may overtake the unwary travelers in the elevated electric railways of Brooklyn and New York. He recounts the case of a fire on a Brooklyn elevated train—probably largely mythical—and then proceeds thus: "Three days earlier a similar conflagration occurred on a crowded train on the South Side Elevated road in Chicago. The motorman was driven from his post by the flames, and in his excitement carried the controller handles with him, but he forgot to turn off the current, and the flaming train, filled with frightened passengers, ran away at full speed. Fortunately, again, the motorman recovered his nerve, fought his way back to the controller through the fire and stopped the train." This harrowing tale has such a slight basis of fact that the Sun correspondent's yarn is ridiculous. The train was not crowded; the motorman was not driven from his post; the train did not run away. There was a broken "pigtail" connection at the contact shoe which caused a display of sparking for a few moments—that was all. There was little excitement and no danger. Still more absurd is the correspondent's cool statement that "In Chicago, experience has shown the railroad company the necessity of keeping a liberal supply of water at the stations in case a train comes in blazing at the motorman's end." The apprehensive correspondent—who demands fireproof steel cars, by the way—may take heart of grace, for his fears are unfounded. No one was ever injured in Chicago on an elevated railroad by fire caused by electricity, and such personal injury is exceedingly unlikely to occur here or anywhere else.

The promotion of industrial combinations does not appear to be languishing just at present. Hardly have the imposing plans of the Continental Telegraph, Telephone and Cable company been made public before it is announced that "a $200,000,000 automobile trust" is organizing in New York to "control the production of every article entering into the manufacture of a bicycle or automobile." The stated capitalization of the Continental company is only $50,000,000, so that it is a comparatively small affair. We are getting so accustomed to big figures and big schemes that a few hundred millions of stock issue doesn't astonish us in the least. The telephone company, it is said, purposes to give the people long-distance telephone service at fair rates in conjunction with existing Independent telephone companies and the Western Union Telegraph company. If that is really the intention of the promoters in relation to the telephone business, their project will receive popular approval, for, as everyone knows, the lack of widespread toll-line connections has been the greatest obstacle to the growth of the Independent movement. Of course, there is the possibility that with only two great telephone systems in the field an easily achieved amalgamation may make but one. Still, there has always been more or less competition in the telegraph business—not very brisk, perhaps, but still far from an unrestricted monopoly—and, with all doubt of patent interference once removed, it seems altogether probable that the regime of telephone exaction and monopoly will be finally done away with, never to be revived.

As for the "automobile trust," the project seems to be in such a vague and uncertain state that speculation may be well held in abeyance for more tangible facts. It is a pretty large contract to attempt to control the carriage builders, motor manufacturers and gas-engine makers of the country. Still, in these days, no one can set the boundary of the combination idea. We must wait to see what we shall see.

In the meantime the "trusts" have their troubles like other folk and more unpretentious enterprises. Texas is one state where they are not regarded with favor. The principle came up in the case of the San Antonio Gas company, and the Court of Civil Appeals has affirmed the judgment of the lower court that the charter of the company has been forfeited because it became a party to a combination to control the public and private lighting of San Antonio. In delivering the opinion of the court, Judge W. S. Ely said: "If the combination was made and its object was in restraint of trade and to create a monopoly, the statute denounces it, no matter if the immediate result of the combination be the temporary reduction of prices. To fix by combination a rate lower than one that has prevailed carries with it the power and ability to establish higher ones, and the object of the statute is to free business and commerce from being controlled by combinations. The state is unwilling to intrust to any combination, even though one of her creatures, the tyrannical and oppressive power that is inseparably connected with the power to raise or lower prices of commodities and control the trade of the country." If the trusts assume such menacing proportions that they become a real burden to the people, it is not to be doubted that the lawmakers of other states will find a way to curb their operations.

Electric Railways in Northern Spain.[1]

By Julius G. Lay.

Until a year ago, such a thing as an electric car was unknown in Spain. The cars in a few principal towns that could boast of having tramways of any kind were drawn through the streets at a jog-trot pace by horses or, more frequently, mules.

Within the last few months, however, foreign enterprise has been the means of inaugurating electric traction in the streets of Madrid, Barcelona, Valencia, Bilbao and San Sebastian, and the lead thus taken by the principal tramway companies in the chief cities of Spain is likely to be quickly followed by others. It appears to me, therefore, that the present moment is particularly opportune for our makers of electrical plants, steam engines, boilers, rails, wire, etc.—to come forward with tenders for the supply of such materials.

The following particulars regarding the most important tramway companies in the north of Spain may prove of interest to any firms desirous of soliciting orders from abroad, and I shall be glad to endeavor to supplement these general remarks by more precise information on any given point of special interest to our exporters or manufacturers.

Barcelona.

Compañia Anonima de Tranvias de Barcelona.—This company, whose present manager is Mr. J. Kennedy, was the pioneer of tramway enterprise in Spain, having first started running its horse cars through the principal streets of Barcelona about 25 years ago, with a 99-year concession from the municipality. The system was changed to electric power in May last, and Dickinson's overhead trolley is used. This company at present owns 85 motor cars besides its old horse cars, but the latter will be superseded by other motor cars when the lines are all in working order. All the new plant required was supplied by a firm of English contractors. The cars were built in Barcelona; the engines and boilers for generating the motive power, dynamos and fittings for the cars were purchased in the United States, and the rails in Belgium. The fares charged are low, 10 centimos (1½ cents) being the fare for a run of five or six miles. The cars are well patronized, and the company is in a flourishing condition, with a capital given at 15,000,000 pesetas ($2,400,000), subscribed for almost exclusively in England. This road has a mileage of about 12 miles through the most frequented streets of the city.

Compañia de Tranvias de Barcelona è San Andres.—This concern about five months ago changed hands, and now, under the able management of a Belgian engineer—Mr. Oscar Schmidt-Corr—is about to effect several important improvements. The traction is to be altered from steam to electricity, and the line prolonged from its present terminus at the outlying township of San Andres, five miles distant, to the manufacturing town of Sabodell, which lies 15 miles north of Barcelona. Another branch line is to be built from Barcelona to Horta, about five miles. The present subscribed capital of this company is given as 3,250,000 pesetas ($520,000).

Compañia de Tranvias de Barcelona à Sans.—This company has a line running from the center of Barcelona to the suburb of Sans, a distance of about three miles. The cars are at present drawn by mules, but the company has asked permission from the town authorities to use electricity as motive power. The capital of this company is 3,000,000 pesetas ($470,000); manager, Mr. Francisco Esdeve.

Compañia de Tranvias de Barcelona à Badalona.—This line of steam tramways connects Barcelona with the neighboring town of Badalona, a distance of about six miles, the rails being laid along the highroad. I have been unable to ascertain whether or not this company intends changing its motive power. The capital of the company, as given, is 2,000,000 pesetas ($320,000); manager, Mr. F. Gillis.

Compañia General de Tranvias.—This road has a mileage of about four miles between Barcelona and the suburb of Sarria. Trains of four cars are drawn by powerful steam locomotives, which are rendered necessary, owing to the sharp curves and steep gradients in the narrow streets of Sarria. I am informed that electric power on this road is soon to supersede steam.

In connection with the tramways of Barcelona, I should mention a small railroad company called the Ferrocarril de Barcelona à Sarria, the only double-track railroad in Spain, about three miles in length, with a capital of 3,000,000 pesetas ($400,000), that has also recently applied for permission to adopt electricity as its motive power in the place of steam.

San Sebastian.

Compañia del Tranvia Electrico de San Sebastian.—The president is D. Antanasio Osacar; manager, M. L. Carlier. This electric road runs for a distance of about five miles through the town of Pasages, which is the commercial port for San Sebastian, as far as the small manufacturing town of Rentiri. All the electrical plant was supplied by La Compagnie Générale d'Electricité de Geneve, of Geneva, Switzerland. The cars were made in Saragossa Spain.

Bilbao.

There is only one tramway company in Bilbao, which runs two lines, with an aggregate mileage of about 19 miles. The motive power is electricity. During last year 2,700,000 passengers were carried; but, as the service is being improved and increased, a better result is looked for this year. The capital of this company is 4,500,000 pesetas ($725,000).

Valencia.

All the city and suburban tramways in Valencia have been bought up by a French company. The plant is now being erected to run the cars by electricity, but the contracts have all been placed with French firms.

There are a few other tramways and railroads in the province of Catalonia, particulars about which I have not yet been able to obtain. The foregoing remarks will, however, serve to show that there is undoubtedly a market in Spain for American electrical equipment.

1. From advance sheets of U. S. Consular Reports. Mr. Lay is consul-general at Barcelona.

Naval Test of Marconi's Wireless Telegraphy.

The naval test of Marconi's wireless telegraphy was concluded on November 1st after three days spent near New York in demonstrating the working of the system under various practical conditions. The operations were made on the cruiser New York and the battleship Massachusetts, under direction of a special commission appointed by the Navy Department. Mr. Marconi was handicapped by incomplete instruments, which had been brought to the United States simply for the purpose of reporting the international yacht races, and was unable to give to the commission as thorough a demonstration of the capabilities of the apparatus as he would have wished. Messages were successfully transmitted between the ships at a distance of 30 miles, but at 36 miles were unreadable. Mr. Marconi expressed his regret at his inability to send messages at a distance of 80 miles, which he asserts he could have done with better preparation.

During the test it was demonstrated that it was possible for any instrument located within the circumscribed radius of transmission to destroy the effectiveness of other instruments at any time. While the Massachusetts, for instance, was telegraphing to the New York the operator at Navesink sent a message at the same time, and the result on the receiving side of the New York's set was a jumble of undecipherable characters. This was done deliberately. Mr. Marconi said that he could prevent this interference on the part of a third station, but that he would not demonstrate it during these tests, because he had not yet received his patents for that feature.

There were no practical demonstrations of the Marconi system made in connection with the signal service of the army, as it was understood that the instruments brought by Marconi to this country are unsuited to greater distances than 12 miles by land or 30 miles by water. The Signal Corps, which operates a system of its own at a distance of 12 miles, was unwilling to have demonstrations made unless there could be assurances of greater distances than those promised.

Mr. Marconi expected to sail for England this week, and it is said that there is a possibility that Great Britain may try wireless telegraphy in its campaign in South Africa.

Proposed Street-railway Ordinance in Milwaukee.

Another step has been taken toward settling the agitation between the Milwaukee Electric Street Railway and Lighting company and the city of Milwaukee, and toward the securing of four-cent fares. At the meeting of the council on November 6th the special committee appointed to confer with the street-railway company reported an ordinance that is expected to settle the trouble. This ordinance extends the franchises of the street-railway company to 1934, when all franchises will expire. The railway company is also given franchises in certain streets which will result, it is said, in its having a practical monopoly of the city so far as street-railway facilities go. In return for this the company is to grant four-cent fares at once from 5:30 to 7:30 in the morning and five to 6:30 in the evening. This is to continue until January 1, 1905, when a general four-cent fare is to be made. It is generally understood that the ordinance is acceptable to the street-railway company, and, in fact, was submitted to representatives of the company before it was introduced. The majority of the council are said to favor the ordinance and it is expected that it will be passed.

The Gold Belt Power company of Hailey, Idaho, has been incorporated by William H. Watt, Arthur Smith, R. W. Berry, W. T. Riley and W. G. Page of Hailey, and M. Parsons and H. N. Coffin of Boise City, Idaho. The objects of the company are to build and equip with all modern appliances an electric power plant to supply power to mines, mills and hoisting works, and for all use in and about them, and in lighting them by electricity; to furnish power for all mining, manufacturing and industrial purposes, for lighting by electricity adjacent towns and buildings therein, for pumping water to mines and mills and for all other useful purposes. The amount of the authorized capital stock of the corporation is $600,000.

Operations of the Signal Corps.

The recent report of Gen. A. W. Greely, chief signal officer of the United States Army, gives an especially interesting account of the year's operations of the Signal Corps, which makes a large use of the electrical methods of communication. The report shows that the telegraph system of Cuba, formerly owned and operated by Spain, has been taken over and developed by the Signal Corps, and that at the close of the fiscal year 2,500 miles of line was in operation, of which 600 miles was absolutely new and the remainder largely reconstructed.

General Greely discusses the question of Cuban cable and telephone concessions, showing the legal and diplomatic difficulties surrounding them, as well as the practical difficulties under which the military cable lines are kept in operation. He recommends the laying of a deep-sea cable between Porto Rico and Cuba, which would cost about $600,000. By this means, all communications between Porto Rico and the United States would pass over strictly American lines.

In the Philippines, General Greely states that the efforts of the United States to lay cables for military operations were antagonized by the private companies owning lines there. General Greely says there are certain provisions of the Spanish cable concessions which plainly cannot be acceded to by the United States, especially the absolute cable rights for an indefinite period, not only in the Philippines, but in all Spanish possessions in the Pacific. He says it is only a matter of time when Luzon will be connected with Formosa by an international cable, thus giving an outlet to Japan and China.

A vague idea of the magnitude of the Signal Corps' work under Major Thompson's supervision in the Philippines, he says, may be conveyed by the statement that over the telegraph system alone more than 260,000 messages, many long and all on public business, were transmitted in the 10 months ended June 30th, and over 45,000 in May alone.

As to a Pacific cable, the report says in part: "In order to join closer together the United States and its Pacific colonies, it is essential to span the Pacific by a submarine cable, as recommended by the president to Congress in his special message of February 10, 1899. The great value of such a cable is not alone for military purposes, but more especially for the fostering of industrial interests in the new colonies and in order to facilitate commercial operations."

General Greely suggests that an international cable conference should consider the whole subject of the rights of cable property in time of war.

Wireless telegraphy receives considerable attention. General Greely says that as a means of connecting the islands of the West Indies, Hawaii and the Philippines, which are in the range of its action, wireless telegraphy should prove of value. The Signal Corps' experiments have shown that its officers and men are able to furnish a practicable system of wireless telegraphy. The Signal Corps has already operated its own system successfully between Fire Island and Fire Island lightship, a distance of about 12 miles. General Greely says there is no reasonable doubt that wireless telegraphy will soon replace, with equal advantage to commerce and the army, the military cables necessary to connect harbor fortifications.

New Electric Line at Niagara.

Apparently there is a bright prospect that before next summer Niagara Falls will have a new scenic route on the American side, as it is reported that the International Traction company intends to extend its Whirlpool and Northern line to Lewiston. This extension would require only about four miles of track construction, as the road is now built to the Devil's Hole. If present plans are carried out, the extension will follow the highway to a point below the Niagara University, where it will turn to the river bank, along which it will run to the Lewiston Mountain. It will pass down the mountain above the tracks of the Rome, Watertown and Ogdensburg railroad, and then pass under them and enter the village of Lewiston, where the extension will meet the tracks of the Lewiston and Youngstown Frontier road, and the cars will run over this line to the dock and depot. Connection will also be made with the new suspension bridge over the gorge above Lewiston. The building of this extension will give the International Traction company a belt-line service about the gorge independent of the Niagara Gorge railroad.

Automobiles on Paris Streets.

A committtee to which instructions were recently given by the Municipal Council of Paris to regulate motor traffic in the Bois de Boulogne and Vincennes is about to submit its report. Automobiles will be restricted to highroads or other regular carriage ways and strictly forbidden to enter the Pre Catelan. The speed of the automobile must in no case exceed 15 kilometers an hour. In busy or narrow thoroughfares it must not exceed a walk. The report ends by stating that these measures are not intended as vexatious restrictions on an industry which has made remarkable progress in the last few years, but are necessitated in the interest of public safety.

DEVELOPMENT OF THE TELEPHONE FIELD.

Continental Telegraph, Telephone and Cable Company.

It now develops, according to the best information obtainable, which is not very definite, that the plan of the lately organized Continental Telegraph, Telephone and Cable company is to solidify the scattered independent telephone systems of the country by building connecting toll lines through the cooperation of capitalists interested in the Western Union Telegraph company. The capital stock of the company is to be increased to $50,000,000, it is said, and the enterprise is to have the strongest kind of financial backing, including the Goulds, John Jacob Astor and the "Whitney-Widener-Elkins syndicate." At first, according to the newspaper statement, the new company will devote itself to the telephone business, in opposition to the American Bell Telephone company; later it may enter the telegraph and ocean-cable field. The attitude of the Postal Telegraph and Commercial Cable companies to the scheme does not seem to be very clear. The office of the company is at 100 Broadway, New York, and William J. Latta of Philadelphia is the president now, although a reorganization may take place in a few days. George W. Beers of Fort Wayne, Ind., and H. J. Hanford of the Kinloch company of St. Louis are other prominent Independent men who are said to be connected with the new scheme.

Many statements in relation to the new company have appeared in the daily newspapers. Most of them are apparently exaggerated and incorrect. The following, from the New York Tribune, is credited to a person closely connected with William C. Whitney: "The enterprise is the work of Martin Maloney of Philadelphia, who has had notable success in combining the electric-light corporations of that city. He has recently become a member of the so-called Whitney syndicate, and in this enterprise he has the backing of his associates in that group of capitalists. There are in the United States east of the Mississippi River about 2,300 isolated Independent telephone companies, and it is the idea of Mr. Maloney and his associates that the company about to be organized by them, which is to come into direct competition with the Bell company, shall make contracts with these Independent companies, and shall construct trunk lines connecting the various cities and towns in which these companies are now giving telephone service, erecting along these trunk lines poles capable of carrying 40 wires.

"The promoters of the new company have been at work upon their project for fully two years, and their plans are well advanced. Their engineers have been in the field for many months, the necessary maps have been drawn, and contracts for the copper wire and the wooden poles have already been awarded. A meeting will be held within a day or two, at which the organization of the national company will be effected. Of course, the new company will make its rates much lower than those charged by the Bell Telephone company, but these rates have not yet been decided upon."

In New York the People's Telephone Corporation will be the local company, it is said, using, possibly, the conduits of the Metropolitan Street Railway company, in which Mr. Whitney is largely interested. New England will be represented by the Massachusetts Telephone and Telegraph company and the Boston and New York Telephone and Telegraph company. The Kinloch company of St. Louis, the new Federal company for the Pittsburg district and the important Independent companies in Cleveland, Columbus and Indianapolis are also supposed to be in the deal. In Chicago the Illinois Telephone and Telegraph company, which has a franchise and has done a little work on a tunnel, is mentioned; but it is to be assumed that if this company is included its automatic-telephone scheme will be given up.

P. A. B. Widener, speaking for the new company, is reported to have said: "We are simply in business to give a good telephone service to persons who have not been able to secure it before by the consolidation of these various Independent concerns. The rates will be made popular. We do not intend any discourtesies or contemplate any warlike measures toward others."

Progress in the Twin Cities.

The Minneapolis City Council has amended the underground-wire ordinance to give the Mississippi Valley Telephone company (Independent) a chance on equal terms with the old company in the suburbs. The old ordinance did not permit the erection of poles and wires in the suburbs, but the old company's lines are already up there. The company will establish a south branch in Minneapolis at Nineteenth street and Fifth avenue South. It is also negotiating for a site for a branch on the East Side. The company has secured an extension of time to get its exchange in St. Paul at work and has been given permission to make a change of its bond. The new company has issued a supplementary list of 144 connections since its directory was issued. It has also applied to the Minneapolis council to have the American Surety company released from its $25,000 bond guaranteeing 1,200 instruments being installed, as this has been done.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Duluth (Minn.) Telephone company has had plans prepared for a modern exchange building and will rebuild its system throughout.

The Willow Creek (Minn.) Telephone company has been forced to build toll lines to Amboy and Nashville Center, Minn.

Telephone operators of the Twin Cities propose a union.

The telephone headquarters at Crookston, Minn., are too small and larger quarters will be secured.

The new Beloit (Wis.) Telephone company will erect a free public-telephone booth in the center of the city, for the use of everyone. The booth will be locked at 10 p. m. by the police.

The Rock County Telephone company has made a proposition to the city of Janesville, Wis., which has been accepted, providing to put in telephones at various places on the streets for the use of the public.

The Mississippi Valley Telephone company expects to have 1,200 instruments in use in St. Paul by November 20th.

A. T. Presson of Hudson, Wis., has concluded not to enter the field at Chippewa Falls, Wis., for an Independent telephone system.

The Wisconsin Telephone company will expend $10,000 at Ashland, Wis., in improvements to the local system.

The Northern Minnesota Telephone company will install an exchange at Park Rapids, Minn., if 40 subscribers can be secured.

The Rushford (Minn.) Telephone company has completed connection with Peterson, Minn.

The Grove City and Rosendale Telephone company has been incorporated to build a line between those cities in Minnesota, and has let the contract for its construction.

The Wisconsin Telephone company has made long-distance connection with Darlington, Wis.

The Board of Public Works of La Crosse, Wis., levied a fine of $5 on the La Crosse Telephone company for leaving a pile of dirt in the street where some poles had been set. The company admitted the presence of the dirt, but urged that, inasmuch as it was furnishing the city with five answer sets free of charge, the fine should be remitted. But the board did not see it that way.

The Wisconsin Telephone company now has 171 subscribers in Beloit, Wis.

The Winona (Minn.) Telephone company is installing a new switchboard.

J. C. Hubinger, of the Mississippi Valley Telephone company, has been in St. Paul recently, and promises that the exchange there shall be working by November 10th, with 600 connections.

Toll-line connection has been completed between Crookston, Minn., and Fertile, Fosston and other towns.

F. E. Albright of Carthage, S. D., contemplates establishing a telephone exchange in Salem, S. D.

A. Von Schlegel of the contract department for the Northwestern Telephone Exchange company, Minneapolis, has been promoted to a higher position in Minneapolis with the same company. Mr. Griffin, formerly in charge of the Grand Forks (N. D.) office of the company, succeeds him. R. H. C. Wood of Minneapolis, late in charge of the South branch, succeeds Mr. Griffin at Grand Forks. N. E. Brown takes charge of the South branch in Minneapolis, in place of Mr. Wood.

The Inland Telephone and Telegraph company of Colfax, Wash., is fitting up a new office.

The press at Pony, Mont., urges the construction of a telephone line from Pony to Norris, Red Bluff, Meadow Creek, Ennis and Virginia City.

Five thousand dollars has been subscribed at Miles City, Mont., for building a telephone line to connect with the other towns of the county.

The Red Lodge and Wyoming Telephone company expects to have connection between Red Lodge, Mont., and Basin by November 20th.

The Independent telephone lines of Iowa are considering a consolidation into one compact body, to better compete with the Bell interests. The absorption by the Bell interests of three Independent companies in Iowa recently has given cause for alarm, and the stronger companies are now about agreed that a closer union is necessary to meet the Bell competition.

The assessment of telephone and telegraph companies in Iowa amounts to $1,628,845 on 96 companies, of which 94 are telephone and two are telegraph companies. Of the 94 telephone companies but two can be called foreign companies (the American Telephone and Telegraph company of New York and the Northwestern Telephone Exchange company of Lowell, Mass.), though there are several whose offices are located in adjoining states, but whose wires penetrate Iowa. The assessed value of the Bell properties aggregates about $242,000. The assessment is based on 25 per cent. of the actual value.

The Ida Grove Telephone company of Ida Grove, Ia., has purchased the materials ordered by the Odebolt (Ia.) Telephone company when the latter was arranging to put in an exchange at Ida Grove.

The Western Electric Telephone company is putting in a line between Mallard and Plover, Ia.

The Elwood Telephone company will install an exchange in Sac City, Ia., at once.

The new exchange at Wapello, Ia., will soon be in operation.

The Iowa Telephone company will build a new line from Boone, Ia., to Ogden.

The Michigan Telephone company will bury some of its wires in Houghton, Mich., in rebuilding the exchange there. Long-distance lines will be brought on from the straits also.

The Northern Minnesota Telephone company will install an exchange in Park Rapids, Minn., at once.

The Independent Telephone company has petitioned the village of Sharon, Wis., for a franchise.

The employes of the Northwestern Telephone Exchange company presented retiring Manager Griffin a silver smoking-set in testimony of their esteem of him. The young ladies of the office also presented him with a silver-mounted umbrella.

The Supreme Court of Iowa has handed down a decision nullifying the present system of taxation for telephone and telegraph, insurance and express companies. The law provided they should pay a percentage of their gross earnings. The court holds that corporations must be assessed on the same basis and for the same purposes as individuals. A corporation paying its entire taxes to the state does not help support the city, county and schools as an individual does, hence the law is unconstitutional.

C. H. Smith of Odebolt, Ia., is an applicant for a telephone franchise at Dennison, Ia.

The Iowa Telephone company is extending a toll line from Cedar Rapids, Ia., to Delaware, where it connects with the line to Waterloo, Dubuque and Chicago.

The Ottumwa (Ia.) Telephone company will build a toll line to Blakesburg, Ia., at once.

Frank Smith of Union, Ia., has been placed in charge of the exchange of the Spirit Lake Telephone company at Harris, Ia.

The local telephone exchange at Waterville, Minn., has been reorganized and will be known as the Cannon Valley Telephone company.

The railroad company at Sewall, Ia., cut the telephone wires crossing its tracks, because they were too low. They had sagged until they would strike a man below the chin, when he was standing on the highest cars. The telephone company proceeded to raise the wires when it repaired them.

A local telephone exchange is projected for Long Prairie, Minn.

Independents Prosperous in La Crosse.

The La Crosse (Wis.) Telephone company is an Independent home concern that has achieved success by methods which have won the confidence and respect of the people. Its latest move is to ask voluntarily for an amendment to its franchise permitting it to place its wires underground. This request, which will doubtless be granted by the City Council, seems to strike the people and press as an exceptionally fair and generous offer and has added to the company's popularity. A director of the La Crosse company is quoted as follows: "Our present plant is even now crowded way beyond its normal capacity, and we cannot accept any new business until we have very materially increased the capacity of our central station. Some time ago we decided upon an increase of our switchboard capacity, and mapped out a plan for the extension of our pole lines. But in the eleventh hour we altered our plans, and decided to ask the Common Council for permission to place all our wires in underground conduits, though it means a great additional expense. Still, our stockholders are all residents and property owners and taxpayers here in La Crosse, and have at all times the best interests of our home city at heart. The necessary material for the conduits has already been contracted for, and work will be started as soon as the ordinance passes and we can get the necessary permits issued under it." The officers of the company are: President, I. H. Moulton; vice-president, W. W. Cargill; secretary and treasurer, William Lohmiller; manager, H. A. Brinckerhoff.

Berliner Hearing in Boston.

[Special dispatch to the Western Electrician.]

Boston, November 8.—The action brought by the American Bell Telephone company against the National Telephone Manufacturing company of this city, and also the case of the Bell company against the Century Telephone company, both brought for alleged infringement of the Berliner telephone patent, are now on hearing before Judge Brown of the United States Circuit Court for the Eastern District of Massachusetts. Yesterday was the opening day of the hearing and was mainly occupied in preliminaries. There is an imposing array of counsel. Fish, Richardson & Storrow, G. L. Roberts, F. H. Betts and W. W. Swan appear for the Bell people; R. P. Payson for the National company, and J. E. and W. Maynalder for the Century company. Judge R. S. Taylor of Indiana is here for the Williams Electric company. J. S. B.

Western Illinois Telephone Association Organized.

The meeting of Independent telephone men in Carlinville, Ill., on November 1st and 2d, was quite successful, although it was necessary to inform several Bell representatives that the deliberations of the assemblage could be conducted without their participation. J. A. Fletcher of Carlinville called the meeting to order, and Dr. I. A. Lumpkin of Mattoon was chosen chairman and Mr. Fletcher secretary. Dr. Lumpkin made an address, in which he said the Independent telephone industry was now on a better footing than ever before. He knew of no reason why the great state of Illinois should not be under the control of the Independents within five years.

H. J. Kusel and J. S. Healy of Chicago and E. J. Huff of Girard were appointed a committee on credentials. James Prawl of Waverley, Charles Drew of Bunker Hill, N. G. Tucker of Virden, W. H. Ramsey of Auburn and Robert Whitely, Jr., were named as a committee on permanent district organization.

On Thursday brief speeches were made at the morning session by H. J. Kusel and J. S. Healy of Chicago, F. H. Stamper of Benton, W. H. Ramsey of Auburn, Charles Drew of Bunker Hill and M. A. King of St. Louis. The committee on permanent organization made the following report:

"We recommend that a petition be presented to the state association at its next session, praying that the state be divided into four districts, namely, northern, southern, eastern and western, and that this district association be known as the Western, the following imaginary line being the boundary: Beginning at the state line at the northwest corner of Hancock County, thence east along the north line of Hancock, McDonough, Fulton and Tazewell counties; thence southeast to the Illinois Central railroad at Bloomington; thence south along the Illinois Central railroad to the Baltimore and Ohio Southwestern railroad; thence west along said railroad to the Mississippi River; thence north to the place of beginning. We further recommend that this Western association be organized this day and date, and all officers for said association be elected and installed by this body, and that one representative for each 50 members or fraction thereof be chosen to represent this association at the state meeting, to have power to act for and in behalf of the association." The report was adopted.

The committee on credentials reported a list of 53 members eligible for admission to the Western District association. It also recommended that all applications for membership hereafter presented should be passed upon by a committee.

Officers and committees were then elected as follows:

President—Thomas W. Wilson, Springfield.

Vice-president—George E. Goodhead, Winchester.

Secretary—James A. Fletcher, Carlinville.

Treasurer—E. J. Huff, Girard.

Executive committee—Charles Drew, Bunker Hill; J. Odell, Moweaqua; Arthur L. French, Chapin.

Committee on constitution and by-laws—Robert Whitely, Jr., Carlinville; W. H. Ramsey, Auburn; U. G. Tucker, Virden; J. A. Fletcher, Carlinville.

Mr. Rogers of Springfield made a speech, showing the situation in that town, and inviting the association to hold its next meeting in Springfield. This invitation was accepted, the date being left with the president and executive committee.

M. A. King of St. Louis, representing the proposed Kinloch toll-line system, made an address, giving interesting statistics, and then the meeting was adjourned.

J. S. Healy of Chicago, representing the Victor Telephone Manufacturing company; H. J. Kusel of Chicago, representing the Eureka Electric company, and Mr. Churchill of St. Louis, of the United States Telephone Manufacturing company, made exhibits.

MANUFACTURERS AND DEALERS.

Among the recent shipments of the Stromberg-Carlson Telephone Manufacturing company of Chicago was a complete interior-telephone system for the United States refrigerating and ice-making plant that the government is building at Manila. The shipment, consisted of an exchange and 20 instruments, with a switchboard capacity for 25. The Stromberg-Carlson company has recently secured two additional floors in the building at 72-82 West Jackson boulevard, where it is located, and now has almost 70,000 square feet of floor space in which to handle its large business.

GENERAL TELEPHONE NEWS.

The purchase of the New Britain (Conn.) Telephone company by the Southern New England Telephone company not only gives the absorbing corporation poles, rights-of-way, etc., which were much desired, but leaves it practically in possession of the field in the state of Connecticut. The price is said to have been $20,000.

At the request of the men, the Chicago Telephone company has raised the pay of its linemen five cents a day for every year's employment with the company. A man who has been with the company three years received an increase of 15 cents a day, and so on. General Superintendent Zeublin said the men were making from $2.25 to $2.50 a day before the raise.

Colonel A. W. Crandell, manager of the Cumberland Telephone and Telegraph company at New Orleans, has resigned his position to accept the general management of Birmingham (Ala.) Cement company. Colonel Crandell has been in the telephone business in New Orleans for 11 years, being formerly manager of the Great Southern Telephone company, which was consolidated with the Cumberland company in 1898.

A combination of the Independent telephone companies of New Jersey is discussed. The Hudson Telephone company is already forming an alliance with the Newark Telephone company for commercial purposes, and these two companies now have connections. The Hudson Telephone company has authorized the increase of its capital stock from $300,000 to $1,000,000, and when the additional $700,000 is floated the work of extension will probably be pushed further.

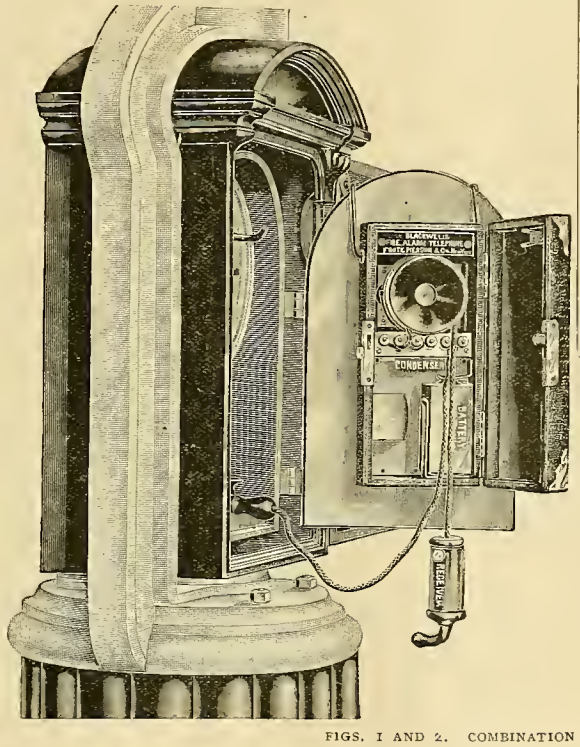
Judge B. F. Dunwiddie of Beloit, Wis., has rendered a decision that the Wisconsin Telephone company cannot erect poles and string wires in highways without the consent of property-owners. The corporation attempted to do this in Beloit last spring, but was restrained by an injunction issued by Court Commissioner Dow in behalf of William B. Strong, ex-president of the Santa Fe railroad, who owns large property interests in Beloit. The case will be appealed.

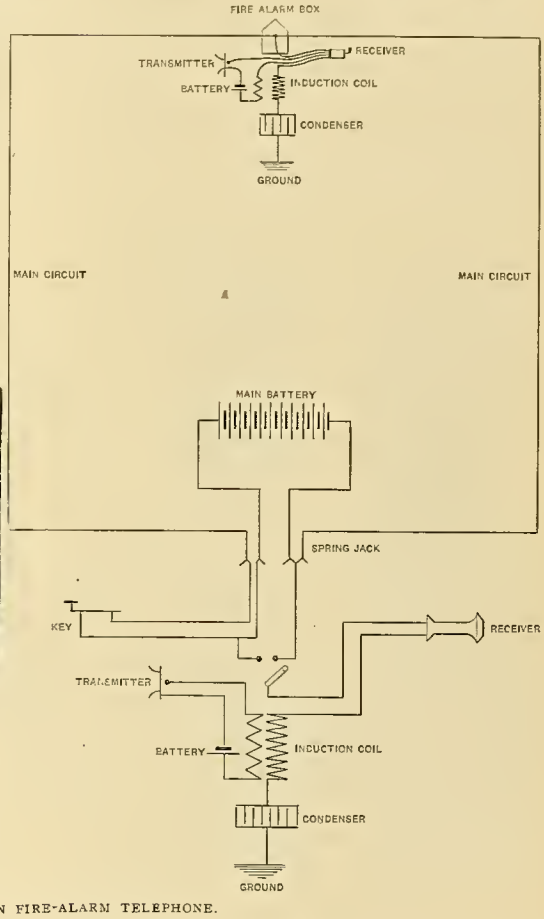
A correspondent writes: "Mr. W. W. Dillworth, proprietor of the telephone exchange at Beloit, Kan., was one of the first to put in an automatic switchboard. He has a well-built metallic-circuit plant and has given the automatic apparatus a very fair test of about two years. But now he has decided to take it out and put in a manually operated switchboard. He is now building toll lines to all of the neighboring towns. Since deciding to change his system and build toll line he has had an increase of over 100 patrons."

Mrs. John H. Outwater, wife of the proprietor of a roadhouse on the Paterson (N. J.) plank road was found unconscious in her room recently, suffering from carbolic-acid poisoning. Her husband telephoned to Dr. White of West Hoboken, to hasten to the house, and the doctor told him what antidote to give the unconscious woman in the meanwhile. When the doctor reached the roadhouse, after a hard drive of three miles, he found that Mrs. Outwater was in a fair way to recover. The family thinks that Mrs. Outwater's life was saved in consequence of the telephone directions.

Combination Fire-alarm Telephone.

A serviceable telephone outfit adapted to be attached to a fire-alarm box, and thus afford a simple and ready means of communication with the central station, is now on the market. It is designed for the use of fire departments, railway employes, etc. The apparatus consists of a telephone outfit without the signaling device, and is compact and portable. To connect the telephone a plug, shown in Fig. 1, is inserted in a receptacle provided in the fire-alarm box. By inserting the plug the telephone is bridged to ground through a condenser. Conversation may be carried on without interrupting the signal or disturbing the electrical connection of any signaling wire with which it may be connected. The outfit is not provided with signaling apparatus, since such devices are supplied in fire-alarm boxes, and may be cheaply provided on other circuits. The bridge wire of the alarm box, which is normally open in the receptacle, is closed when the telephone is connected. Fig. 1 shows the outfit attached to the door of a fire-alarm box and connected ready for use. As may be judged by the illustration, the apparatus is compact and portable.





FIGS. 1 AND 2. COMBINATION FIRE-ALARM TELEPHONE.

In Fig. 2 is shown a diagram of the connections with a box and the main circuit of a fire-alarm system. When used on electric and other railways receptacles may be placed at suitable intervals on a wire provided with some open-circuit signaling device or a ground detector at the receiving end. An ordinary transmitter and receiver of any pattern may comprise the outfit at the receiving end of the circuit, the induction coil and condenser being of the same resistance and capacity as those in the portable set.

This combination telephone outfit is manufactured by Foote, Pierson & Co., 82 Fulton street, New York, successors to E. S. Greeley & Co.

Night Operater Calls for Help.

"Help! I'm dying!" was the message which reached the operator in the Brooklyn central office of the New York and New Jersey Telephone company recently. It was six o'clock in the morning, and the agonizing words came over the wire from the Coney Island exchange, says the New York Tribune. In vain the operator in the central office tried to get Coney Island to answer and explain the queer message. The circuit was open, but there was no response. The young woman in the central called up police headquarters. Another message was sent over the private police wires to the Coney Island station. A policeman at once went to Chamber's drugstore in Surf avenue, where the telephone exchange is located. He broke in the door and found the operator lying unconscious on the floor. Help was summoned and the young man was revived. The physician who attended him says that the case was one of partial suffocation. A search was made, but no leak in the gas could be discovered.

Sterling Enclosed Arc Lamps.

The Sterling Arc Lamp company feels that in order to show the uniform record of its lamps, it has but to point to the many now in use throughout the country and the favorable reports which are constantly coming in from light stations and private consumers. It has always been the company's aim to provide a lamp mechanism which could be universally adapted for use on any circuit, and the lamp described herewith was designed with the object of accomplishing this result.

Briefly, the Sterling arc lamps employ exactly the same feeding and controlling mechanism whether used on direct or alternating currents. To obtain this has necessitated most careful study, experiment and designing, but as a result the company feels that it has not only succeeded in producing a universal arc-lamp mechanism, but one which has proved itself of the utmost reliability and sensitiveness of feed, and one of exceedingly simple and substantial construction.

Fig. 1 shows a general outside view of one of the Sterling lamps. The mechanism of these lamps is the same, whether used on alternating or direct circuits, and consists, it is claimed, of the smallest number of working parts that can possibly be combined with any satisfactory results. The lamps are built for alternating or direct-multiple, constant-current series and railway circuits, and also series-alternating circuits. In all of these types the same general lines are retained with but few and slight detail modifications.

The regulating mechanism of the Sterling arc lamps is a novel form of clutch of the chain-feed type, and consists, very briefly, of three eccentrically movable segments engaging the rim of a drum-shaped sprocket wheel. While extremely sensitive, this clutch is of great strength and durability, and as no current passes through any part of it, it is claimed that it will not wear out. The employment of this form of feeding mechanism is said to overcome the objectionable features experienced in the center-feed type of lamp, such as the sticking or burning out of sliding contacts, overheating of the spools, etc. A point that will be appreciated is the direct connection with the upper carbon by a fireproof flexible cord. The carbons are clamped by thumb-screws, making the best contact. All parts of the lamp which are likely to oxidize are either nickeled or japanned. For outdoor use the lamp is provided with a weatherproof housing and top.

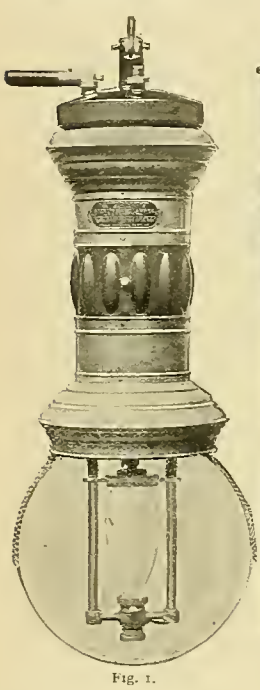


Fig. 1.

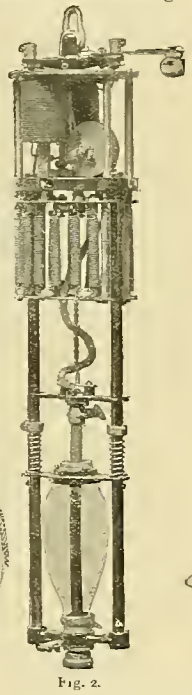


Fig. 2.

Fig. 3.

Fig. 4.

STERLING ENCLOSED ARC LAMPS.

Fig. 2 shows the mechanism of the Sterling lamp for direct-current, constant-potential incandescent circuits. These lamps burn singly on 100 to 120 volts, using about 4½ to five amperes and 80 volts to the arc. They are also made for three amperes. The lamps are provided with a common link fuse, protecting the spools from burning out by accident or short-circuiting in the arc. A 12 by one-half-inch upper and six by one-half-inch lower carbon should be used for 4½ to five-ampere lamps; for three-ampere lamps, seven-sixteenths-inch carbons should be used. The five-ampere lamps are rated at 2,000 and the three-ampere lamps at 1,200 candle power.

The resistance of the lamp takes the difference of potential between the arc and the line. By cutting in or out portions of this resistance, the voltage at the arc can be adjusted so that the lamp can be operated on circuits having any potential from 100 to 120. No adjustment on the mechanism is necessary at any time. The length of the Sterling direct-current lamp is 28 inches.

The Sterling arc lamp for alternating circuits burns singly on 95 to 120 volts at 60 or 125 cycles frequency, using six amperes and about 70 volts. This lamp is also made for 3½ amperes. For six-ampere lamps one-half-inch carbons are used and for 3½-ampere lamps seven-sixteenths-inch carbons are necessary. Every lamp is provided with a switch. The regulating coils are double series, connected with the reactive coil, and acting on double laminated-iron cores attached to the bar. Coil spools and other metal parts adjacent to the coils are of non-metallic material. The length of this lamp is 29 inches. The six-ampere lamps are rated at 2,000 and the 3½-ampere lamps at 1,200 candle power. The reflector type of alternating-current lamp is represented in Fig. 3.

The reactive coil, shown in Fig. 4, on the top of the lamp, allows adjustment for range of line voltage from 95 to 120 volts, and an adjustment for 60 to 125 cycles. To adjust the lamp to any desired voltage it is only necessary to connect the flexible cord leading from the switch to the reactive coil. The loops at the bottom of the coil are for the voltage only. The two loops at the top of the coil are, one, for 7,200 alternations; the other, for 16,000 alternations.

In the Sterling lamp for constant-current series circuits, the mechanism is the same as in all Sterling lamps. The two spools are wound with coarse wire for series connection and with fine wire for shunt connection. As soon as the arc is started this coarse wire is cut out and the shunt does the feeding continuously. A mechanical cut-out short-circuits the two binding posts of the lamp before the carbons are entirely consumed, in this way disconnecting the feeding mechanism and spools, so that no current passes through them. Another cut-out is provided, which operates in case of accident to the carbons. This cut-out is operated by the shunt magnets, and acts as soon as the voltage in the arc rises above normal. The armature is controlled by an adjustable spring. Changing the tension of the spring will change the voltage in the arc. The mechanism is free from all friction caused by dash-pots or sliding contacts. The resistance in the shunt spools is 800 ohms and only .1 ampere or eight watts are required to operate the feeding mechanism. The series winding being cut out when the lamp is burning, no current whatever is lost. It is claimed that this lamp will burn satisfactorily between four and seven amperes without further adjustment. The length of the lamp is 32 inches, and it is adjusted for 6.8 amperes and 72 volts in the arc. Its rated candle power is 2,000.

The Sterling lamp switch or line cut-out for constant-current series lamp is a new feature, and, it is claimed, embodies advantages possessed by no other similar device. This switch is in a separate case, which is hung from the supporting hook, and consists of a double centrally pivoted knife-blade switch, operated by a suitable handle, so that the lamp is entirely disconnected from the line and the current is not shunted through the lamp. The line wire enters this switch box, being properly looped, and the terminals from the switch to the lamp project through the bottom of the switch base, in the form of two heavily insulated brass hooks. On top of the lamp hood, which is particularly substantial, are two corresponding hooks, and to connect the lamp to the terminals from the line projecting through the switch base, it is simply necessary to engage the hooks on the lamp with those from the bottom of the switch box. This is done by a rotary movement, and to facilitate this operation, and also to prevent any swinging of the lamp, and to hold the hooks firmly together, a centrally placed pin, from the top of the lamp hood, enters an aperture in a projected stud from the switch-box base. This pin serves both as a pivot and a steadying pin or bolt.

The regulating mechanism of the Sterling series alternating arc lamp is differential, consisting of series and shunt double coils. The H-shaped laminated core is flexibly connected with the feeding mechanism to avoid vibration. The automatic cut-out is arranged to operate in case of accident to the carbons, or when the carbons are all fed. The copper disk of this automatic cut-out is so adjusted that it breaks the contact before the carbons separate. Lessening the tension of the spring attached to the lever will raise the amperes or lower the voltage in the arc; increasing the tension will lower the amperes or increase the voltage. The length of the series alternating-current lamp is 30 inches.

The Sterling lamps for power and railway circuits are similar in construction to the series constant-current lamps. They burn two in series on 220 volts and five in series on 500 volts, taking 4½ to five amperes. A switch is provided on top of each lamp and the same sized carbons are used as in the direct-current lamps. A resistance is provided on each lamp, which is so arranged that should one lamp accidentally go out the other will continue to burn.

Westinghouse Electro-pneumatic System of Motor Control.

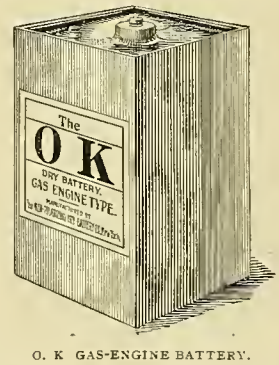
Mr. George Westinghouse has invented a new system of controlling any number of electric motors from one point, and a two-car train equipped with the controlling apparatus is now running experimentally between Wilmerding and East Pittsburg, Pa. The method of control can be used for such work as moving cranes, lifts and for controlling the apparatus used in charging coke ovens and furnaces, as well as on trains. When applied to train control, each motor car is fitted with the usual current-collecting and controlling devices and a full set of air-compressing and air-storage apparatus is used on at least one car. Auxiliary storage apparatus is placed in each motor car. The controller proper may be of any standard type designed for railroad work, but instead of the usual hand lever, a device worked by air power is employed, and this device may be used in connection with any form or design of controller.

O. K. Gas-engine Battery.

The Non-polarizing Dry Battery company of New York, in putting out the O. K. cell, illustrated herewith, calls attention to the special advantages of its dry battery for gas-engine work. The disadvantages of wet cells for this purpose are apparent, so that a dry battery capable of doing the work, with the added qualities of compactness in size and light weight, should be popular with gas-engine builders and users.

The cell is seven inches high by 4½ inches square. This square form is believed to give a battery longer life and greater efficiency, with the minimum amount of floor space, than any other shape that can be used, and the company has finally adopted this form in all its batteries, after long practical experimenting and demonstration.

The number of cells used depends upon the nature of the work to be done, and for that reason careful attention must be given to the dimensions and data of the gas engines for which the batteries are to be adapted in order to give the best results. These cells are boxed complete connected in series, and ready to apply to the engine, the igniting coil being also in the case and protected from moisture and careless handling.



O. K GAS-ENGINE BATTERY.

At an annual meeting of the Newport News and Old Point Railway and Electric company, held at Newport, Va., recently the following board of directors was elected: William J. Payne, F. W. Darlinog, George A. Schmelz, Alexander Brown, John B. Kimberly, Samuel Regester, L. P. Stearnes, C. B. Orcutt and James McMenamin. A meeting of the directors resulted in the election of the following-named officers: President, William J. Payne; vice-president, L. P. Stearnes; treasurer, H. L. Schmelz; secretary, D. C. Zollicoffer; general counsel, Charles T. O'Ferrall and Samuel Regester.

Lea Enclosed Arc Lamps.

In beginning its second year's business, the Lea Manufacturing company of Elwood, Ind., has moved into a new factory, is fully equipped with automatic machinery for producing duplicate lamp parts, and is in much better position to handle its increasing business. Although retaining the simple construction which has made the Lea lamp so successful in the past, a number of improvements have been introduced, both in the internal mechanism and in the design and finish of the covers.

Lamps are now finished in polished brass, nickel, oxidized copper and black enamel. In both alternating and direct-current lamps a hinged cover is used, which can be opened with one hand and has no loose parts to hold or let fall. The dash-pots are all made of fiber-graphite, as, it is said, experience has shown it to be better suited for this purpose than brass or nickel. The graphite is not affected by heat, is self-lubricating, does not wear loose and will not stick. A relief valve is placed in the top of the dash-pot, allowing it to drop quickly when feeding. The closed bottom inner and outer globes have been adopted for all types of lamps, as they are less apt to break, make trimming much easier and add greatly to the life of the carbons. No gaskets are used, the inner globe being pressed against a ground joint at the top by a phosphor-bronze spring, insuring freedom from air leaks.

Fig. 1.

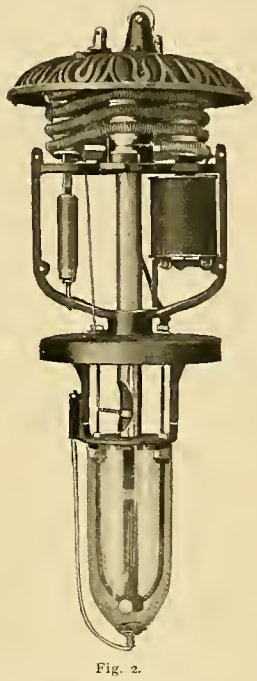


Fig. 2.

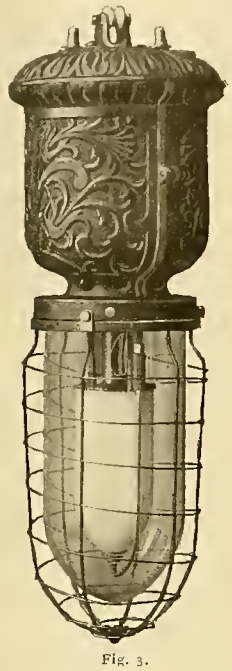


Fig. 3.

LEA ENCLOSED ARC LAMPS.

The alternating lamp is made on much the same lines as the direct-current, and is identical in outward appearance and size. It is asserted to be as near noiseless as it is possible to attain, and gives nearly the same life as the direct-current lamp. Being provided with adjustable reactance, the same lamp can be used on both 7,200 and 16,000 alternations, by simply changing one connection. As usually adjusted, the alternating lamps consume 425 to 450 watts and give a clear, white light.

Among the newer types are a marine lamp, a shade lamp and a baby lamp. The last-named is only 16 inches long, burns 50 to 60 hours and is adjusted to 2½ amperes on 110 volts. It is only finished in polished brass and is intended for interior use.

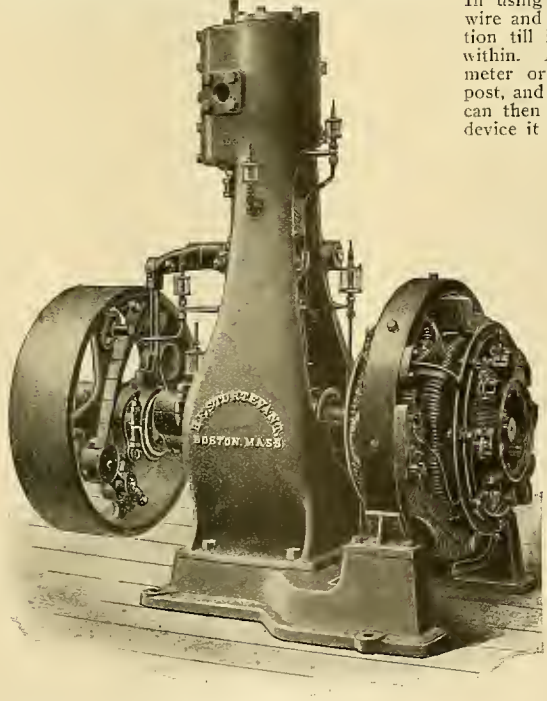
Of the illustrations Fig. 1 represents the standard Lea lamp, finished in plain black enamel. Fig. 2 is a view of the direct-current lamp with cover removed. This lamp is made in two styles, to work singly on 100 to 120-volt circuits or across a 220 to 250-volt circuit. In Fig. 3 is shown the marine lamp, which is adapted to be used either for marine work or where lamps are exposed to rough usage in mills or factories. A steel cage entirely surrounds the outer globe. These marine lamps are made for 110 or 220-volt circuits, either direct or alternating.

A handsomely illustrated catalogue has been issued by the Lea company, which contains descriptions of the lamps manufactured by the company and detailed accounts of the construction and operation of the lamps.

At a recent meeting of the stockholders of the Tri-city Railway company of Davenport, Ia., directors were selected as follows: E. E. Cook and James F. Lardner of Davenport, H. A. Ainsworth and F. C. Denkmann of Moline, Ill., and W. H. Edwards of Rock Island, Ill. The board organized by electing the following-named officers: President, E. E. Cook; vice-president, F. C. Denkmann; secretary and general manager, James F. Lardner. The company expects to have its Rock Island line finished and in operation by December 15th.

Sturtevant Generating Set.

In most cases generating sets are provided with outboard bearings for the armature shafts. In the type herewith illustrated, this extra bearing is done away with and the armature is overhung upon the end of the engine shaft. In order to secure compactness the generator is of the eight-pole type, the field ring being of wrought-iron, cast-steel or cast-iron, according to the size of the machine. The pole-pieces are of wrought-iron and are provided with cast-iron shoes of such shape and size as to render the machine capable of extreme variation of load without sparking at brushes or without shifting the adjustment. The field coils are wound in such a manner as to present the greatest amount of radiating surface, and the armature is built up of laminated steel disks, mounted on a cast-iron spider, having a hub projection for the reception of the commutator. A commutator of large diameter is used, which consists of pure rolled or drop-forged segments, supported by a cast-iron spider, and thoroughly insulated with mica and micanite.



STURTEVANT GENERATING SET.

The design of this machine is such that a very small amount of energy is dissipated at the brushes. The spider construction allows perfect ventilation on all sides, and consequently a cool commutator. Reaction brushes of fiber-graphite are used. No shifting of brushes is required from no load to full load, and sparkless operation is maintained. The engine is cast in a single piece, is very compact, and all wearing parts are arranged for adjustment. The engine cylinder is lagged; reliable oil devices are provided for all bearings; and a delicate regulator, by its operation, maintains a practically constant speed. The valve of the engine is of the piston type, and therefore practically balanced. High speed is made possible by means of counterbalanced crank disks. The governing wheel and the armature serve to assist materially in resisting any sudden variation of speed.

This set is one of a line of generating sets designed and built by the B. F. Sturtevant company of Boston, Mass. The smallest sets have a four-by-four engine, with an output of 3,000 watts and a combined weight with the generator of 1,100 pounds. The largest size is seven-by-seven engine, with an output of 10,000 watts and a combined weight of 2,700 pounds. These engines are designed to operate at 90 pounds pressure. A line of sizes is also made that is suitable for operation at very low pressure.

TELEPHONE TALES.

A police-court hearing was recently conducted by telephone in a Kansas town. The defendant, who was charged with assault and battery, evaded arrest when he learned that a warrant had been sworn out for him, but engaged a lawyer. The latter called up the county attorney at a town 30 miles distant, who in turn called a justice into the conference. The defendant's lawyer entered the appearance of his client over the telephone and pleaded guilty for him, and the justice imposed a fine of $5 and costs. The lawyer remitted it by draft in the afternoon mail.

There is a popular character in Pendleton who has a slight impediment in his speech. He talks eloquently, but he stammers some. He recently located in Pendleton because he admires Missourians, and he has found the right kind here. The other day, says the Pendleton East Oregonian, which tells the story, he went to the telephone to talk to a friend in Portland. When the talk was finished the Portland man said: "Well, old man, you seem to talk better since you went to Pendleton. You do not stutter anything like as much as you did." "No," said the Pendleton man, clear and straight as a bell. "A man cannot afford to stutter through a telephone when to talk costs 75 cents a minute."

Insulated-wire Tester.

A new and ingenious labor-saving device is being manufactured by the Star Brass Works of Kalamazoo, Mich., in the shape of a wire tester. The invention, which has been patented, is illustrated in the accompanying picture. It has a steel head, bent in such a shape that it will hook over a wire. A binding post affords means for connecting one lead of a voltmeter to the instrument. The unique feature of the device, however, consists of a fine-threaded screw, with a sharp point on one end and a wooden handle on the other. This screw point turns in a thread in the shank of the head. In using the tester the hook is placed over the wire and the point is screwed through the insulation till it makes a good contact with the wire within. A connection being made to the voltmeter or other instrument through the binding post, and a suitable "ground" being made, the wire can then be easily tested. By the use of such a device it is not necessary to scrape off the insulation of a portion of the wire in order to get a contact, and neither is it necessary to wind the wire with tape after the test has been made. The saving in the lineman's time is obvious. The hole made by the screw point is very small and, it is said, is negligible, so far as injury to the insulation is concerned. In the illustration the tester is represented full size. This particular size will fit any insulated wire up to No. 4, and for larger wires a larger tester is manufactured. The device is nickel-plated and can be easily carried in the vest pocket. Any further information regarding this interesting "wrinkle" will be furnished by the manufacturers.

INSULATED-WIRE TESTER.

Bullock Marine Generating Set.

The combination illustrated in Fig. 1 consists of a Bullock type "N-I" generator direct connected to a Forbes marine engine. The engine cylinder is five by five inches and is made for the high pressures of modern marine practice. The cylinder is supported upon three hollow steel legs, which are rigidly fastened to a sub-base common to both engine and generator. To two of these supports the cross-head guide is securely bolted. A system of sight-feed lubricators is installed upon the side of the cylinder, with copper tubes leading to all of the wearing surfaces of the engine.

A small balance wheel is provided and assists in the regulation of the engine speed. The governor, which is installed on the outer end of the shaft, is of the inertia-centrifugal type, and maintains a speed between no-load and full-load limits of less than two per cent. variation. The valve is of the

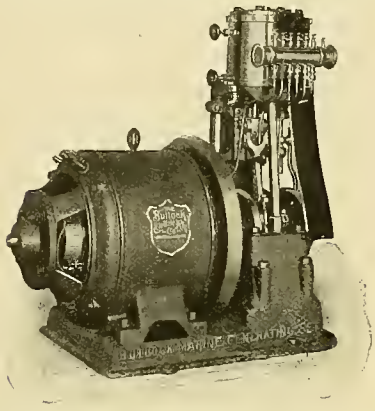


FIG. 1. BULLOCK MARINE GENERATING SET.

cylindrical balanced type and gives a perfect steam distribution.

The generator is shown in section in Fig. 2. The yoke is a steel casting of the conventional circular form, having inwardly projecting pole-pieces of laminated soft steel. Each pole is bolted to the frame by two bolts (A A). The armature core (D) is built up of laminated soft steel mounted directly upon the shaft and held firmly together by iron end plates (E) and nuts (F), as shown, one end plate resting against shoulder (G). Ventilating slots (H) perpendicular to the shaft provide a perfect means of ventilation. The windings (I) are machine formed and hot pressed and are perfectly insulated before being placed in the slots of the core. The windings are held in place by steel-wire bands wound in slots, making a flush finish with the outside of the laminated core. The armature shaft rests in a phosphor-bronze bearing of liberal dimensions at the outer end and is key-seated in the hub of the engine flywheel, which is of extra width and provided for receiving the end (K). The commutator

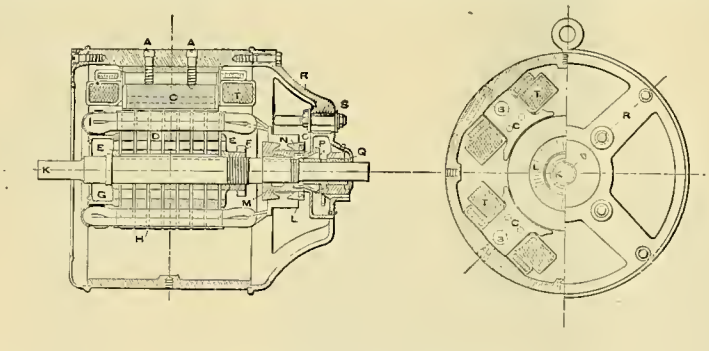


FIG 2. BULLOCK MARINE GENERATING SET.

bars, shown at (L), are held together by sleeve (M), ring (N) and nut (O). Oil shield (P) prevents oil from finding its way from bearing (Q) into the armature. The bearing (Q) is of the self-oiling type, as shown. The end housing (R), securely bolted to the frame, carries the brush studs (S). The field coils (T) are machine wound and thoroughly insulated, and are slipped over the poles before the latter are bolted in position.

The engine operates at 600 revolutions per minute, and at this speed the capacity of the generator is five kilowatts at 115 volts' pressure. The manufacturer, the Bullock Electric Manufacturing company, Cincinnati, O., will be pleased to send Bulletin No. 2234, showing other engine-type generators, to those requesting it.

Two electric railways are contemplated for Biddeford (Me.) and the neighboring city of Saco. One is named the York County electric railroad and will be 25 miles long, passing through Waterloo, Limerick and Hollowell. The capital of the company which will build this road is $250,000. The other line is the Biddeford, Kennebunk and Wells railway, and its company is capitalized at $200,000.

CORRESPONDENCE.

New York Notes.

New York, November 4.—Winslow E. Buzby, the lawyer who was arrested on a charge of disorderly conduct for attempting to operate his automobile in the roadways of Central Park, has been discharged. Magistrate Olmsted, in the Yorkville Police Court, before whom the case was brought, refused to entertain a complaint against Mr. Buzby in view of the fact that it had not been shown that an automobile was not a pleasure carriage.

The question as to the advisability of admitting automobiles and motor carriages to Central Park was taken up by the park commissioners at their meeting last Thursday. The subject was introduced by President Clausen, who offered a resolution providing for a public hearing by the board on the question on next Thursday at 11 a. m., "to all persons interested in the matter who may desire to be heard for or against such proposed admission." The resolution was unanimously adopted.

The first run of the Automobile Club of America took place this afternoon. It started from the Waldorf-Astoria Hotel and proved as attractive a sight as has been seen in this city for a long time. The run was a success and no accident occurred to mar the event. There were 22 electric vehicles, including seven cabs, four steam vehicles, eight with gasoline motors and one gasoline tricycle. The parade passed down Madison and Fifth avenues to Mount Morris Park and over Riverside Drive to the Claremont, which was the turning point. At the head of the line were General Avery D. Andrews, president of the club, and Jefferson W. Seligman in an electric vehicle.

It is said that the contract for the engines to be installed in the new power station of the New York Light, Heat and Power company has been awarded to the Westinghouse Machine company, the order calling for 16 engines of 5,500 nominal horse power each. This new station will be called the Waterside station and will be erected on First avenue, between Thirty-eighth and Thirty-ninth streets.

What is regarded as a step in the merging of all of the electric-light companies of Manhattan and Brooklyn boroughs and as the forerunner of the consolidation of everything of this character in Greater New York was taken Monday last in Brooklyn. At a special meeting of the stockholders of the Kings County Electric Light and Power company it was voted to lease all its property and its franchise to the Edison Electric company for a term of 38 years. The object of the lease, it was stated, was to bring about a greater compactness in the operating of the electric business in Brooklyn and to do away with double taxation of franchises. It will also place all of the electric-lighting franchises now in existence in Brooklyn under control of the Edison company, with the exception of the Amsterdam company of Williamsburg. The Edison company passed resolutions merging the Municipal and Citizens' companies. As a result of this merger it was estimated that there would be a saving of between $60,000 and $70,000 a year.

A contract has been closed with the Electric Storage Battery company, which calls for storage batteries aggregating 10,000 horse power, to be used by the Third Avenue Railroad company in connection with the electrical equipment which has recently been put into operation upon its lines. The batteries will be located at two sub-stations.

Judge Bookstaver of the Supreme Court has granted a final order dissolving the Excelsior Electric company of No. 115 Broadway, and appointed Charles E. Dustin permanent receiver. The liabilities were $230,000, of which $166,000 was bonds and $49,800 interest. The assets are $26,338.

M. L. G.

PERSONAL.

William Leslie Edison, youngest son of Thomas A. Edison, was married on November 7th to Miss Blanche Fowler Travers at Elizabeth, N. J.

W. F. Furbeck, formerly connected with the Yerkes street-railway interests in Chicago, has formed a partnership with his son, R. J. Furbeck, under the name of W. F. Furbeck & Co., to do a brokerage business.

Francis W. Parker and Donald M. Carter have formed a partnership under the name of Parker & Carter, for the general practice of law, including patent litigation and patent soliciting, with office at 1410 Marquette building, Chicago.

John H. Adellman, who succeeded S. A. Passmore as superintendent of the Plainfield (N. J.) Street Railway company's line six years ago, has been made superintendent of the Elizabeth and Westfield Street Railway company, which is owned by the Riker-Hine syndicate, and will superintend the operation of the trolley lines between Plainfield and Elizabeth. His headquarters will be in Plainfield. Superintendent Adellman began work for the company as a motorman.

Mr. C. J. Reilly, chief engineer of the Chicago City Railway company, resigned his position with that company on November 1st. Mr. Reilly had been connected with the company for six years, and by his ability and unfailing courtesy had won the sincere good-will of his associates and many other friends and acquaintances. He has planned to engage in other business about January 1st and in the meantime will enjoy a rest which has been well earned. Mr. C. H. Wilson, formerly of St. Louis, will succeed to Mr. Reilly's position.

TRADE NEWS.

The Consolidated Electrical Supply company of Brooklyn has been incorporated with a capital stock of $10,000. The directors are F. S. Braillard, Jr., Grace B. Braillard and Charles T. Boyd of Brooklyn.

Sealed proposals, without date, are being invited by Charles W. Goodman, superintendent of the Indian School at Chilocco, O. T., for furnishing that institution with a large quantity of electric supplies, a full list and description of which will be furnished upon application.

Becker Bros. of Chicago, the well-known electrical repairers, recently suffered a loss of $2,500 by fire. The loss was fully covered by insurance. The firm expects to resume business at its old location, 30 West Washington street, by the 15th of this month. It has considerable work on hand, but will not suffer any great delay.

For the second time inside of 12 months the factory of Roth Bros. & Co., Chicago, manufacturers of the well-known Roth electrical machinery, has been burned out. This time, fortunately, the loss was not as great as that experienced in the previous fire. The damage done amounted to about $2,500, which was fully covered by insurance. The firm will resume business at the old location, 88 West Jackson boulevard, by November 20th. Several large orders on hand that were ready for shipment were entirely destroyed.

BUSINESS.

The Western Electric company sells the New Century and Perfection incandescent-lamp guards recently described in the Western Electrician.

The Electric Appliance company, Chicago, reports a steady increase in sales of all classes of electrical supplies. The increase in sales of its Packard transformers is said to easily lead the list.

Thompson, Sons & Co., 107 Liberty street, New York city, announce that they have a number of exceptional bargains in new and second-hand dynamos and motors, as well as transformers. This firm makes a specialty of handling second-hand machinery.

Users of cross-arms, pins, brackets and similar woodwork will be interested in the announcement of the Texas Arm and Pin company of Beaumont, Tex., which claims to possess special facilities for filling orders for this class of construction material. The company is prepared to quote low prices on its products and is anxious to hear from those in the market for material of this kind.

Referring to the display of the Montauk Multiphase Cable company of New York at the recent electrical exhibition in Wilmington, Del., the committee on exhibits of the National Association of Municipal Electricians says: "Your committee, in speaking of this cable and its appurtenances as being a great boon for the protection of life and property throughout the world, feels that, in doing so, it has only seconded the voice of the people, and that this invention will prove, by its great general utility in the saving of life and property, to be one of the most useful of the nineteenth century."

The Western Electrical Supply company of St. Louis, selling agent for the Adams-Bagnall enclosed arc lamps for all circuits, states that after exhaustive experiments lasting through a period of over two years, added to the unity of opinion as expressed by the trade generally, it has become convinced that the heavy pressed copper, as applied by the Adams-Bagnall company for arc-lamp cases, is the most practical and natural covering for an arc lamp. Such a case, made up in the form adopted by the Adams-Bagnall company, is said

to embody rigidity, indestructibility and absence of weight. This case has been used on all of the arc-lamp company's latest products, and while the first cost is necessarily greater, the many advantages are said to be so evident that the considerate and care-taking trade is quick to realize and welcome the change. The Western Electrical Supply company adds that its calls for the heavy-pressed copper-case lamp are decidedly on the increase, and that the Adams-Bagnall arc lamp in this covering bids fair to have no recognized competitor with the people.

The Bullock Electric Manufacturing company reports 55 orders for the month of October, the machines ranging in size from the smallest to 300 kilowatts' capacity. Among the orders received were one from the Maryland Steel company of Sparrows Point, Md., and one each from the London (England) Star and St. Petersburg (Russia) Novia Urenia, for the Teaser newspaper-press equipment. Two 300-kilowatt generators were shipped to the Wilson Aluminum company of Holcombs Rock, W. Va., to be used in the manufacture of ferro-chrome.

A. C. Becken of Chicago, manufacturer of the Paillard non-magnetic watch, announces that this watch is in greater demand than ever before. This is probably due to the fact that it is such an appropriate and useful gift for the holidays, and consequently an early demand has already been felt. It is perhaps needless to state that the Paillard watch, which is so extensively in use all over the country, is uninfluenced by magnetism, and consequently is of special benefit to those who come in proximity to dynamos and other electrical machinery. The watch is said to be indorsed by some of the greatest electricians and scientists.

Steward's patent lava insulation has been tested in the laboratory of the Thomson-Houston company, which is said to have certified voluntarily to the excellent qualities of lava and to have backed its opinion with orders to the present time of probably 10,000,000 pieces of various sizes and shapes. It is stated that the lava stands heat that will melt a firebrick, and that it is truly and absolutely fireproof. It is particularly available for makers of arc lamps of all kinds on account of its high resistance to the arc, as well as to heat, in small pieces. it can be made to fit accurately to 0.01 of an inch, either in plain or screw-threaded pieces. The manufacturers have facilities for turning out from 15,000 to 20,000 pieces daily, and on orders for a thousand pieces or upward do not make any charge for molds or tools, unless the piece is unusually difficult to make. The material is asserted to be much stronger than glass or porcelain, or, in fact, any vitreous material. All the large manufacturing electrical concerns of this country are said to be using many thousands of pieces. The manufacturers are just in receipt of a letter from the Royal Imperial College of Japan, acknowledging the receipt of a number of pieces sent some time ago, of which the writer speaks in the highest terms. The lava lends itself to the manufacture of a limited number of articles, in which it is desired to use hushings or washers, screw-threaded or plain, on account of there being no expense for molds and tools in small lots and the short time in which orders can be filled after receipt. This material is made by the D. M. Steward Manufacturing company of Chattanooga, Tenn.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 31, 1899.

635,739. Armature for Dynamo-electric Machines. Sigmund Bergmann, New York, N. Y., assignor to the General Incandescent Arc Light company of New York. Application filed November 15, 1898.

An armature disk is described which has stamped-up portions bent at right angles to the plane of the disk, some of the stamped-up portions being arranged at approximately uniform angles to the intersecting radii of the disk.

635,740. Electric Arc Lamp. Sigmund Bergmann, New York, N. Y., assignor to the General Incandescent Arc Lamp company of New York. Application filed November 25, 1898.

Combined in the lamp are a slotted directing tube, a carbon holder included within the tube, a ring surrounding the directing tube and connected with the carbon holder through a pin which moves in the slot of the directing tube, and a conductor of electricity wound helically around the directing tube and connected at one end to the tube and at the other end to the ring.

635,750. Dynamo-driving Mechanism. John L. Creveling, New York, N. Y. Application filed June 30, 1899.

Means are provided for use with an axle or shaft to be operated in connection with a driving belt, the means comprising an auxiliary belt normally inoperatively inclosing the axle or shaft, and adapted to be readily substituted in operative position for the ordinary driving belt upon the breaking of the latter, and an inclosure for retaining the auxiliary belt in inoperative position around the axle or shaft and adapted to retain it until its services are rendered necessary as a substitute for the first-mentioned belt.

635,765. Electric Signal. Harry T. Gibbs, Portsmouth, R. I., assignor to himself, Stanton M. Foye and Frank G. Sweeney, Portsmouth, R. I. Application filed February 9, 1899.

A signal system for electric railroads is described which combines a plurality of street lights located in a shunt from the trolley circuit, a signal light, a semaphore a telephone circuit, means located at a central station for sending a current over the telephone circuit to set the semaphore, and electrical connections controlled by the semaphore for cutting out one of the street lights and lighting a signal light, whereby the number of lights in the shunt from the trolley circuit will be kept constant.

635,774. Storage Battery. Arthur Heinemann and Wilhelm Schäfer, Berlin, Germany. Application filed September 4, 1897.

The battery comprises a vessel, electrodes coated with an active material, and molded partitions made of pulverized non-conductive vegetable charcoal completely filling the spaces between the electrodes and the spaces between the latter and the battery vessel, the partitions saturated with the electrolyte, whereby a dry battery and a support for the active material on the electrodes are obtained.

635,786. Means for Regulating Constant-potential Transformers. Waldo A. Layman and Ferdinand Schwedtmann, St. Louis, Mo. Application filed February 27, 1899.

There are combined with a constant-potential transformer and its circuits, one of the circuits being an auxiliary circuit of constant potential, and another a circuit of varying potential with constant current, the transformer having independent primary and secondary windings, a source of supply for the transformer in the form of an alternating or pulsating current, a switch or switches in a circuit or circuits of the transformer, and automatic regulating means for controlling the switch or switches, which means is electrically energized by the auxiliary constant-potential circuit and the circuit of varying potential with constant current. (See cut.)

635,812. Telephone Transmitter Arm. Lambert Schmidt, New York, N. Y. Application filed September 26, 1898.

A support for telephone transmitters combines a fixed bracket having conducting surfaces and a pivoted arm secured within the bracket, the arm being formed of two conducting rods separated and insulated one from the other and having at their inner terminals contact springs bearing upon the conducting surfaces, and carrying at their free ends a transmitter whose terminals are in electrical connection with the rods.

635,814. Stylus for Producing Illuminated Sentences. Josiah Scott, Toledo, O. Application filed March 31, 1899.

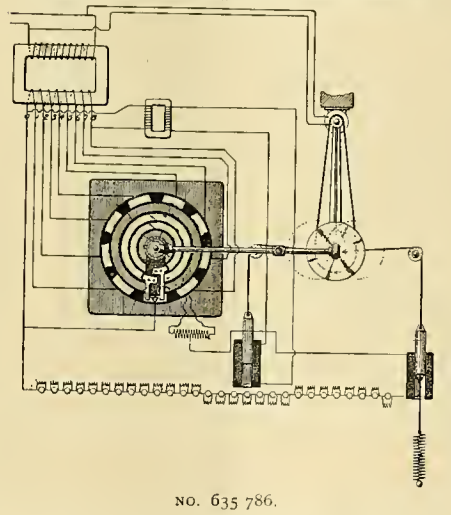
In a stylus for producing illuminated letters and characters on a darkened field are a handle composed of insulating material, bifurcated to receive a metal holder, into which is adapted to be inserted a strip to remove the paint on the face of a slate, and a carbon or metal strip to serve as a contact, a spring attached to the handle having secured to the end thereof a section of carbon, an electric circuit controlled by the spring and adapted to produce an arc when the spring is operated manually.

635,815. System and Apparatus for Controlling Electric Vehicles. Elmer A. Sperry, Cleveland, O., assignor to the Cleveland Machine Screw company, Cleveland, O. Application filed September 6, 1898.

In the system are included a dynamo-electric machine used to generate currents periodically, a controller for the circuits of the machine, a set of contacts on the controller connected with the field coil of the machine and an electric battery also connected to the set for fixing the residual magnetism of the field of the machine before starting upon the generating periods.

635,816. System and Apparatus for Controlling Vehicles. Elmer A. Sperry, Cleveland, O., assignor to the Cleveland Machine Screw company, Cleveland, O. Application filed September 17, 1898.

In a system of control for electric vehicles are combined a source of electrical supply, a motor, a stopping and starting switch, an independent circuit-adjusting current-graduating device, independent manually actuated manipulating mechanism for the switch and the device and a mechanical operating connection between them, the switch and the device being in series circuit relation.



NO. 635 786.

635,819. Electric Arc Lamp. Hans O. Swoboda, New York, N. Y., assignor to the General Incandescent Arc Light company of New York. Application filed August 29, 1898.

The lamp combines a supporting frame having an upper and a lower plate, a feed magnet supported between the same by a flexible mounting, and stops extending from the magnet to within a short distance of one or more of the plates, together with sound-deadening material located at all possible points of contact between the stops and the plates.

635,820. Telegraphic Block-signal System. William C. Taber, North Collins, N. Y., assignor of two-thirds to Frank E. Gaylord and Charles M. L. Ashby, North Collins, N. Y. Application filed July 2, 1898.

The combination of a telegraphic line, normally continuous from end to end and including stations with receiving and sending instruments, a ground connection for the line which is normally broken, a signal device and means controlled by the signal device which when the signal is moved out of its normal position positively completes the ground connection of the line.

635,851. Electric Arc Lamp. Charles E. Harthan, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 23, 1898.

The lamp has a frame, two sets of magnets pendent therefrom, movable cores for the magnets, a lever fulcrumed to the frame and connected by links with the cores, a second lever in operative relation to the first lever, a link for connecting one end of the second lever with the frame, a clutch carried by the last-mentioned lever and a feeding rod actuated by the clutch.

635,852. Coin-controlled Telephone-call Apparatus. George B. Heath, San Francisco, Cal. Application filed October 31, 1898. Renewed October 4, 1899.

In the device are a coin chute in sections, with the sections separated horizontally and insulated from each other by an insulating block supporting the lower section, the sections being connected with the main lines, and a lamp and key in circuit with the main lines. (See cut.)

635,862. Electric Arc Lamp. Edward S. Lea, Elwood, Ind., assignor to the Lea Manufacturing company, Elwood, Ind. Application filed August 8, 1898.

There are combined with the lamp a frame, including a cross-bar, a dashpot suspended near one side of the frame on the under side of the cross-bar, a solenoid suspended near the other side of the frame, also from the under side of the cross-bar, a lever pivoted at one end to one side of the frame adjacent to the solenoid and extending across beneath the solenoid and dashpot, and connected by a pivot connection to the core of the solenoid and also to the piston of the dashpot, a hanger connected to the lever at a point between its connections with the core and piston, and extending downward and connected to the carbon clutch, and the carbon clutch arranged to be operated through the mechanism.

635,880. Summation Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed June 20, 1898.

A number of recording devices independently effecting desired registrations are combined with a separate motor device controlled by each register, a summation register for all the motors, and gearing between the motors and the register such that each motor actuates the summation register to record the movement of its own controlling device independently of the other motors.

635,881. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed September 2, 1898.

The meter has in combination an armature mounted on a shaft, a field magnet therefor, a stationary load coil surrounding the armature shaft, a second load coil mounted on the armature shaft and free to move up and down thereon as the induction between the coils varies, a centrifugal governor also mounted on the shaft, a contact controlled by the governor for opening and closing the circuit of the armature, and means for adjusting the relation of the contacts. (See cut.)

635,910. Electrical Instrument. Wilfrid S. Boult, London, England. Original application filed December 30, 1897. Divided and this application filed May 2, 1899.

In a relay or other electrical instrument are combined a pair of magnetically connected cores and means for temporarily energizing one of the cores whereby the other core is given an opposite polarity, and a deflectable tongue magnetically connected with the cores and controlled in its movement by the cores.

635,930. Electric Cigar Lighter. Frank H. Harriman, Hartford, Conn., assignor to Edward E. Claussen, Hartford, Conn. Application filed March 29, 1898.

The invention consists of a handle adapted for conducting an electric circuit and for inclosing the operative parts of the lighter, the glowing member forming one terminal of the electric circuit and mounted at the base of the handle, a plug of insulating material having a recess filled with pulverized carbonaceous material, a communicator having a reduced shank borne by the plug and forming the other terminal of the circuit when brought out of the normal position, a connector loosely mounted in the communicator, and a conductor rigidly mounted in the communicator.

635,938. Means for Cleaning Hulls of Vessels. David Mason, New York, N. Y. Application filed November 11, 1898.

A mechanism for cleaning the bottoms of vessels afloat is described consisting of an electromagnet scraping device provided with pivoted hooks and scrapers or abraders, and circuit connections running to a source of electrical energy on the vessel for causing the device to adhere to the bottom thereof, in combination with one or more jet holes or openings and a flexible steam pipe running to a liquid-heating source, together with means for moving the device at will.

635,939. Means for Repairing Vessels While Afloat. David Mason, New York, N. Y. Application filed November 11, 1898.

A patching device for repairing damages to floating vessels at points below the water line, consisting of electromagnetic means for closing the opening or hole where the damage is done, in combination with electrical connections for causing the electromagnetic means to adhere to the side or bottom of the vessel.

635,941. Safety Attachment for Propelled Vehicles. John P. Müller, New York, N. Y., assignor of two-thirds to Louis Goldsmith, Jr., and Nathan Gold, New York, N. Y. Application filed August 5, 1899.

In an electrically propelled vehicle are combined a main circuit, a motor therein, wheels driven by the motor,

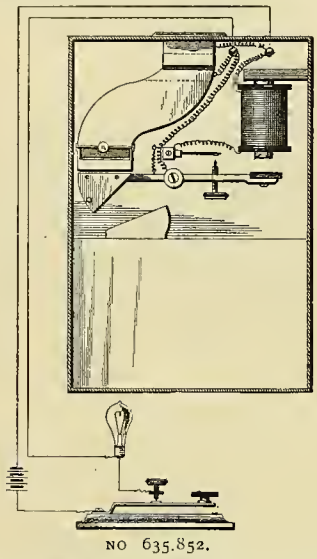
a shunt, a circuit-closer therefor, means for operating the circuit-closer, a second circuit, a switch, a solenoid in the shunt for operating the switch to cut out the main circuit and throw in the second-circuit, brakes, a solenoid in the second circuit, and means operated thereby to bring the brakes into operative engagement with the wheels.

635,944. Combined Telephone and Push Button. Benjamin F. Smith, Bay City, Mich. Application filed November 26, 1897.

There are combined with a telephone structure, a push button included therewith and forming a part thereof, the stem of the push button passing through the core and diaphragm of the telephone, together with a cam or equivalent means for holding the circuit normally broken, and a push button connected therewith for completing the circuit while the telephone is in use.

635,960. Conductor and Cable Terminal. Henry G. Grush, Boston, Mass. Application filed August 24, 1899.

A terminal for an electric cable is described consisting of an impermeable sheath inclosing a plurality of conductors insulated with fibrous material for the principal part of the cable's length and with flexible waterproof insulation at their terminals which extend beyond the end of the sheath, a section of the waterproofed insulation being tightly compressed by a winding or hand and the sheath hermetically sealed thereto.



NO 635.852.

636,021. Device for Operating Electrically Illuminated Signs. William T. Bell, Nottingham, England, assignor to the Universal Electrical Advertising Syndicate, Limited, Nottingham, England. Application filed October 19, 1898.

The device combines with a horizontally reciprocating and intermittently rotating drum having imperforate contact plates on its respective faces, stationary switchboard provided with a series of yielding contact terminals, and means for preventing sparking upon the breaking of contact between the contact plate on the drum and the contact terminals, the means comprising a rotating circuit-breaker which breaks the lamp circuit at the moment before the drum recedes.

636,023. System of Control for Electric Motors. James R. Cravath, Chicago, Ill., assignor to the General Electric company of New York. Application filed May 4, 1898.

The method of preventing the racing of electric motors is described which consists in decreasing the torque of any motor whose counter-electromotive force rises above the average counter-electromotive force of the motors of the set, and allowing the torque to remain at the value normally due to the current actually flowing, on any change of counter-electromotive force of the motors as a set. (See cut.)

636,028. Electric System for Automatically Governing Polyphase Circuit-breakers. Axel H. Engstrom, Philadelphia, Pa. Application filed January 28, 1899.

The system comprises a polyphase circuit, transformers in series with the polyphase circuit, a motor having a field ring connected with the transformers and an armature under a constant torque and adapted to control the circuit-breaker, the transformers adapted to set up a rotary magnetic field in the field ring which exerts upon the armature a continuous but varying torque in opposition to the constant torque.

636,029. Automatic Circuit-breaking Device for Polyphase Currents. Axel H. Engstrom, Philadelphia, Pa. Application filed January 31, 1899.

A circuit-breaker interposed in a polyphase current is combined with a motor having a field ring whereon a rotary magnetic field is adapted to be set up from the polyphase current, an armature under the continuous but varying torque of the field, means for holding the armature under a constant opposing torque, and mechanism controlled by the armature for operating the circuit-breaker when the torque of the field overcomes the constant opposing torque on the armature

636,030. Circuit-breaker. Axel H. Engstrom, Philadelphia, Pa. Application filed February 3, 1899.

The circuit-breaker comprises a casing, a shaft arranged vertically within the casing and having a bearing in the base of the casing, a switch lever arm or blade adapted to turn with the shaft, two nuts adapted to be advanced in opposite directions on the shaft, to confine the switch arm or blade to the shaft, and a spiral spring or its equivalent interposed between one of the nuts and the switch lever.

636,056. Electric-lighting Gas Burner. Rufus C. Nourse, Boston, Mass. Application filed May 12, 1899.

In the device are combined a burner having a plug or valve, an arm on the plug, a spindle mounted to turn in a bearing on the burner independent of the plug and having an arm, collars loosely mounted on the respective arms, and a link pivoted to the collars and connecting the arms.

636,057. Electric-lighting Gas Burner. Rufus C. Nourse, Boston, Mass. Application filed May 12, 1899.

In this device an operating device is connected with a plug or valve of the burner and carries the movable electrode.

636,069. Electric Bell. David Rousseau, New York, N. Y., assignor to Charles M. Higgins, New York, N. Y. Application filed July 21, 1899.

The electric bell has in combination a coil, a pivoted armature therefor, a pin carried by the armature, a hammer with which the pin engages, an electric circuit extending through the coil and adapted to be broken between the pin and hammer, a spring for returning the hammer to its normal position, and a spring for limiting the return movement of the armature.

636,081. Lightning Rod. Harry J. Stuart and David D. Woodman, Swain, N. Y. Application filed May 25, 1899.

The combination with a lightning rod or conductor and a battery, of an automatic circuit-breaker in electrical connection therewith whereby an electric current is intermittently passed through the rod or conductor.

636,087. Electric Motor for Fans. George A. Tower, Richmond, Va., assignor to the Tower-Binford Electric and Manufacturing company, Richmond, Va. Application filed July 20, 1899.

The motor is provided with a vertical support, a stationary field magnet attached thereto and having its upper side recessed to form an oil cup around the support, the support extending downward into the oil cup, an armature carrier carrying an armature and a tubular shaft, this shaft embracing the central support and extending down into the oil cup.

636,089. Burglar Alarm. Daniel L. Wartzenluft, Kutztown, Pa. Application filed May 24, 1899.

A burglar alarm, comprising an electric circuit, wires of which are adapted to extend across a window or the like, a circuit-closer carried by one of the wires, auxiliary circuit-closers having connection with the wires and consisting of spring-pressed levers with which the wires are connected, plates on which the levers are mounted, the plates being insulated one from the other, and spring-pressed contacts adapted to be carried by the window sash and having electrical connection with the plates.

636,090. Air Heater. Edwin R. Waterman and Robert R. Morison, San Francisco, Cal. Application filed May 11, 1899.

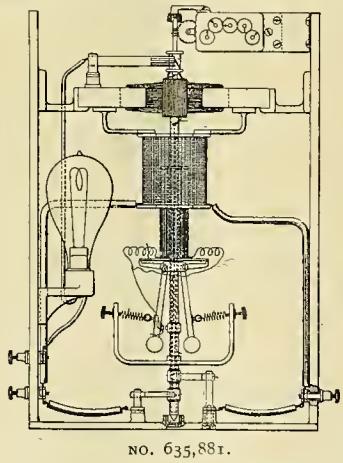
An air heater for dental and other purposes is described consisting of an exterior cylinder having an open rear end and a handle portion removably fitted to the open end, an interior air-conducting heating pipe and coil, a nozzle connecting with the discharge end of the pipe, an electrical heater surrounding the air pipe and an insulating surrounding therefor, wires connecting the heater with the source of electrical supply and a contact-making and breaking device interposed in the electrical circuit.

636,091. Fluid-heating Apparatus. Edwin R. Waterman and Robert R. Morison, San Francisco, Cal. Application filed May 11, 1899.

The apparatus comprises an exterior containing-vessel having rigid therewith an interior double-walled chamber segmental in cross section, an electric heater introduced through the lower open walls of the double-walled chamber and adapted to occupy the space between the double walls, means for supporting the vessel and chamber and means for removably securing the heater in position.

636,093. Electromedical Apparatus. Marcy L. Whitfield, Memphis, Tenn., assignor of one-half to Charles C. Cowan, Memphis, Tenn. Application filed March 29, 1899.

A method of treating disease which consists in placing the body or part thereof to be treated within the influence of a hanging field of magnetic force, and including the body or part in that portion of a secondary circuit in which currents are generated by the changing field of magnetic force.



NO. 635,881.

636,097. Electrical Measuring Instrument. Vittorio Arcioni, Ivrea, Italy, assignor to Camillo Olivetti, Ivrea, Italy. Application filed May 10, 1899.

The instrument has an index movable over a calibrated plate, a spring acting upon the index in one direction, a multiplying arm supported rigidly at one end and having its other end connected to the index to counteract the action of the spring, and a wire connecting the terminals of the instrument and secured to insulated points between the terminals, one point being on the multiplying arm near the point of support of the latter, and the other insulating point being rigid on the case near the axis of the index.

636,116. Automatic Relay. Frank E. Chapman, Medford, Mass., assignor to William G. Nixon, Braintree, Mass. Application filed August 27, 1896. Renewed March 6, 1899.

The relay embodies in its construction an induction coil, an armature, a coil for the armature connected with and operated by the secondary circuit of the coil, an independent or local circuit including the armature, and means for preventing reverse signals in the independent circuit due to changes of polarity of the primary circuit, the means comprising contact points and a switch included in one of the circuits.

636,134. Telephone-call Register. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station company, Hartford, Conn. Application filed October 8, 1898.

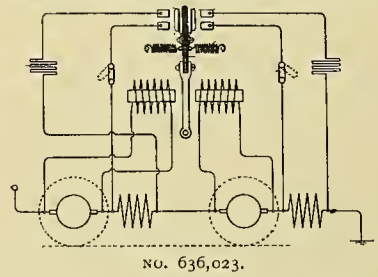
A telephone toll apparatus is described which has an indicating device, means for operating the indicating device through the medium of travelers of different construction, means for ejecting the travelers of one set after the operation of the indicating device and means for retaining the travelers of another set after the operation of the indicating device.

636,135. Coin Holder for Telephone Pay Stations. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station company, Hartford, Conn. Application filed January 6, 1899.

In a toll-collecting device are combined a plate having a coin slot, a holder located in position to retain a coin with its edge projecting beyond the mouth of the channel, and means for withdrawing the holder from the channel whereby the coin travels thereafong by its initial force.

636,139. Fire-alarm Signal Circuit. William R. Hewitt, San Francisco, Cal. Application filed March 28, 1899.

An engine-house local circuit containing gongs and releasing devices, branch circuits having different closing contacts, and a switch in the local circuit so arranged as to be normally closed to different closing contacts alternately, or to the different closing contacts simultaneously, and so arranged as not to be open at any position to all closing contacts simultaneously.



NO. 636,023.

636,142. Secondary Battery. Albert E. Hodgson, Halifax, England. Application filed July 31, 1899.

A separator for the plates of secondary batteries is formed of glass fibers woven into a flexible fabric and secured at the edges.

636,182. Electrical Measuring Instrument. Frank W. Roller, New York, N. Y. Application filed November 5, 1898.

In the instrument are combined a magnet, a coil carrying the current to be measured, an indicating device operated by the current in the coil, two extension pieces of magnetic conducting material, each connected with one of the poles of the magnet, the extension pieces overlapping each other and having an influence upon the coil, and a loop of electric conducting material carried by the indicating device, one side being adapted to move between the extension pieces.

636,189. Trolley Pole. Silas Vernoy, Toronto, Canada. Application filed January 20, 1899.

The invention consists of a trolley pole and connections for a double-wire overhead-electric car-line system, comprising a tubular pole, divergent tubes extended from the upper end of the pole, trolley blocks supported at the upper ends of the tubes, but insulated therefrom, trolleys mounted in the blocks and means comprising wires extended through the pole and tubes, for completing a circuit between the trolleys and the motor of a car.

636,203. Electric Resistance. Hugo Helberger, Thalkirchen, Germany. Application filed April 19, 1898.

An electric resistance consisting of a non-conducting backing or supporting plate, and a facing of metallic foil impressed upon or into the supporting plate.

636,209. Telephonograph. Jules E. O. Kumberg, London, England. Application filed August 14, 1899.

A combined telephonic and phonographic instrument is described comprising phonographic and electro-telephonic diaphragms connected together to cause either to be actuated by the other, sound boxes containing the diaphragms and connected together by a tube, a mouthpiece provided with a telephonic transmitter and a sound duct from the mouthpiece to the connecting tube of the sound boxes.

636,212. Electro-depositing Cell. Marcel Perreur-Lloyd, London, England, assignor to the Electrical Copper company, Limited, London, England. Application filed December 28, 1897.

The cell has an anode and a rotary cathode, a normal animal skin or membrane arranged in light contact with the rotary cathode and freed from all matters which can become soluble or adhesive at or below 60 degrees Fahrenheit.

636,229. Means for Placing, Removing and Cleaning Electric Lamps. Elwyn E. Simms, Albert Lea, Minn., assignor of one-half to William E. Lockerby, Minneapolis, Minn. Application filed October 1, 1898.

Features of the invention are a pole with expansible grasping fingers or clamps, means for expanding or contracting the fingers or clamps, revolving mechanism the motion of which operates the expanding or contracting means and revolves the fingers or clamps, and means whereby the revolving mechanism may be operated.

REISSUE.

11,780. Electrically Propelled Vehicle. Louis Krieger, Paris, France. Application filed June 20, 1899. Original number 607,997, dated July 26, 1898.

In the apparatus are combined steering wheels, an independent armature connected to each wheel, a fixed magnet in conjunction with each armature, a steering apparatus having independent electric connections to each armature, and a source of electrical energy, the field-magnet windings and the steering apparatus being connected in series with the source of electrical energy.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, NOVEMBER 18, 1899. No. 21

Recent Extensions of Alternating-direct Central-station Work in Chicago.

It is interesting to note the increase during the last year of alternating-current transmission and direct-current distribution systems for electric-lighting and general power uses, as well as for long interurban electric railways. As applied to Edison three-wire lighting circuits, the first introduction of this combination alternating and direct-current system is accredited to the Chicago Edison company. More than two years ago this company put in its first combined system of this character. The scheme comprised a three-phase, alternating-current transmission line from the Harrison street station to station No. 2 at Twenty-seventh street and Wabash avenue, where, by means of transformers and rotary converters, the alternating current was changed to direct current and then distributed in the usual manner over the Edison three-wire systems radiating from the station. This installation was fully described in the Western Electrician of January 1, 1898. Since that time several important additions have been made to the Twenty-seventh street station; and to accommodate the increase of the company's business on the North Side a rotary-converter sub-station has been located on North avenue, receiving its power over a three-phase, alternating-current transmission line from station No. 5, located at Washington and Market streets, in the downtown district.

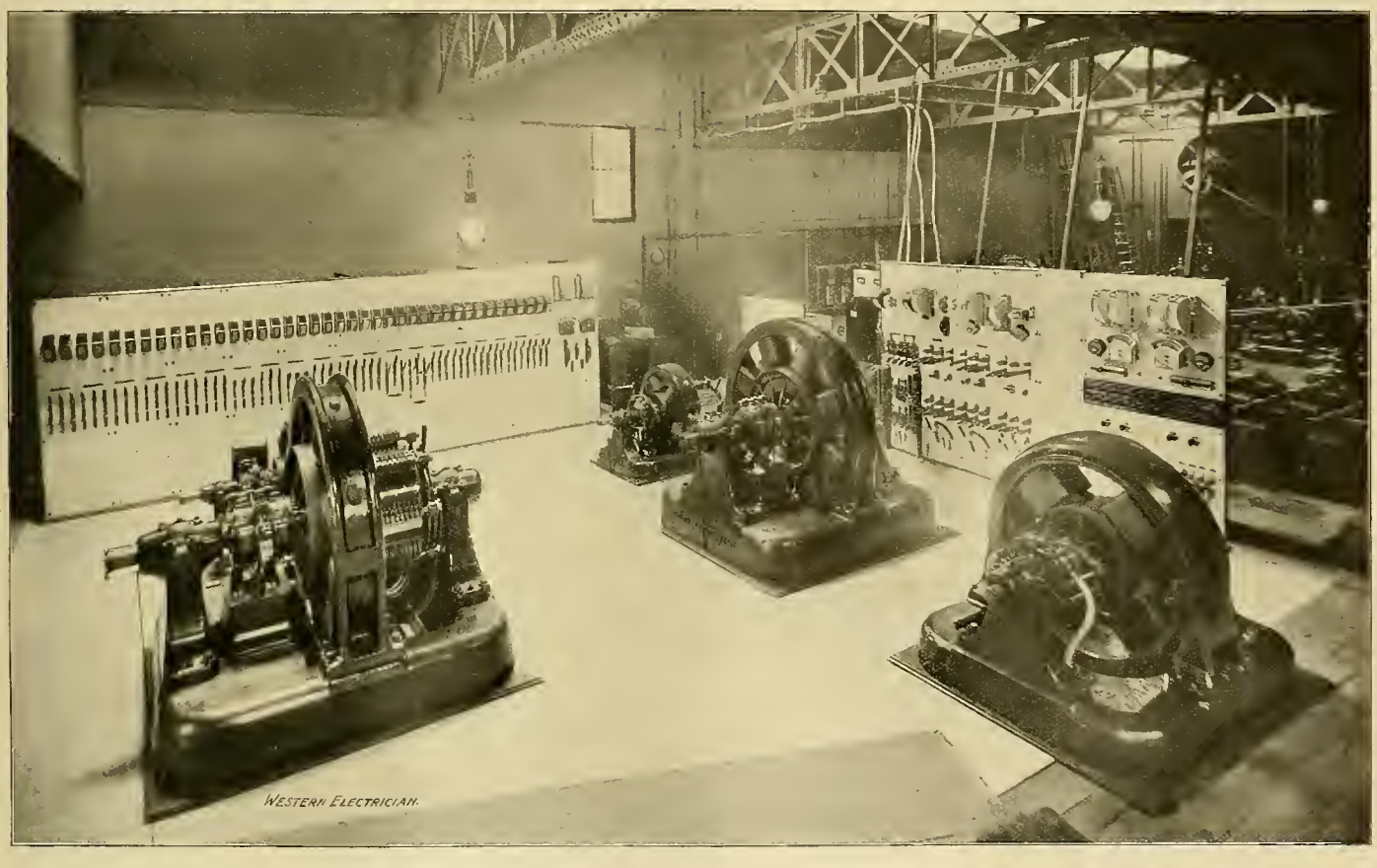


FIG. 1. RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—ROTARY CONVERTERS AT WABASH AVENUE STATION OF CHICAGO EDISON COMPANY.

Twenty-seventh Street Station.

Originally station No. 2, at 2634 Wabash avenue, or the South Side station, as it was called, was equipped with steam engines and direct-current apparatus exclusively. But in 1897 the company's engineers worked out a plan to effect greater economy by transmitting power from the large, new, modern station at Harrison street. At that time two rotary converters, fed by a single three-phase transmission line, were installed. Later two more rotaries were placed in operation, and during the last year a fifth rotary converter was added. To help out the transmission line previously installed a new line was run from the Harrison street station on the west bank of the Chicago River at Harrison street, a distance of 3½ miles. These two cables are of the same size, being three-conductor, No. 0, B. & S. gauge. They transmit three-phase current at 4,500 volts to station No. 2, where it is converted to low-tension through static transformers, and by means of rotary converters is changed into direct current, feeding into the three-wire, low-tension network in this district. This gives a duplicate transmission line, allowing the use of either cable or both in multiple.

The switchboard in which these cables terminate at station No. 2 is provided with three single-pole, quick-break knife switches, mounted on a marble board and separated from one another by slate barriers. Either cable may be disconnected at will. This transmission-line switchboard is shown in Fig. 1, at the left end of the operating board.

From this terminal board cables lead to bus-bars on the back of another high-tension switchboard. This board consists of three panels and is used to connect the high-tension circuits to the static transformers. On each panel are mounted three single-pole, high-pressure switches operated by rack-and-pinion. A portion of this board may be seen at left of Fig. 2 (page 294), which also shows some of the static transformers.

There are 12 of these static transformers mounted upon a marble base and cooled by an electrically driven blower. Six of the transformers are of 150 kilowatts' capacity each and reduce the pressure from 4,500 to 80 volts. They are connected in two sets of three each, and each set is joined to a section of the transformer board. The third set of transformer switches is connected to the remaining six transformers, which are of 40 kilowatts' capacity each. Between the low-tension or operating switchboard and the transformers are placed induction regulators, operated by motors mounted thereon and controlled from the switchboard. These regulators are used to raise and lower the alternating-current voltage impressed upon each rotary, thereby adjusting the load. Two of these regulators are shown in Fig. 2 in front of the transformers.

Of the rotary converters previously installed and connected to the first transmission line, two are 100-kilowatt, 125-volt machines and two are 200-kilowatt, 125-volt units. There has been added this year one 250-kilowatt, 250-volt rotary converter. The new 250-kilowatt rotary is connected to the set of six 40-kilowatt transformers, which give 160 volts at their low-tension terminals. The direct-current side of this rotary is connected to both the positive and negative bus-bars of the three-wire system, while with the other rotaries one 100 and one 200-kilowatt machine feed into the postive bus and the other two into the negative bus-bar.

Fig. 1 gives a good general view of the rotary converters and the switchboards of the station. On the left of the picture is shown the switchboard for the low-tension, direct-current feeders, with switches and instruments for 16 separate circuits. Directly in front of this board are the two 100-kilowatt rotaries and the two 200-kilowatt machines. The 250-kilowatt converter is seen at the right in the foreground. The four left-hand panels of the operating switchboard, shown on the right of the illustration, contain the indicating, regulating and switching apparatus for the rotary converters. The low-tension alternating current from the transformers and induction regulators comes first to this board and then to the rotaries. After being changed to direct current, it passes back through the board and then, by cables, to the bus-bars of the low-tension feeder board.

To assist in the regulation of the voltage, and as a reserve in case of accident, a storage battery has been installed in this station during the present year and is just completed. The battery is of the well-known type manufactured by the Electric Storage Battery company of Philadelphia, and consists of 150 cells, 75 cells being connected to each side of the three-wire system. Each cell contains 33 plates, 15½ by 15½ inches in size. The capacity of the battery is 4,000 ampere-hours, at the eight-hour discharge rate.

An economical utilization of space has been obtained in the location of the battery, as the cells have been placed in two separate rooms, one above the other. Each room contains 75 cells, the upper room holding the positive side of the battery and the lower room the negative. The two rooms are located in a fireproof addition built on one side of the station building. Fig. 3 is a view in the negative battery room, showing the copper conductors leading to the end-cell switches, which are located

on a balcony at the end of the positive-battery room. These switches are four in number, two being connected to each side of the three-wire system, so that the battery may be operated at two different voltages, or may be charged and discharged at the same time, if necessary. The end-cell switches are operated by motors controlled from the storage-battery switchboard, which is shown to the right of the operating board in Fig. 1. Indicators on the board show the number of cells in series. This battery is equipped with all of the most modern appliances for convenience and safe and rapid operation.

Besides the equipment mentioned station No. 2 contains a vertical Ball & Wood 600 horse power engine, direct connected to two 200-kilowatt, direct-

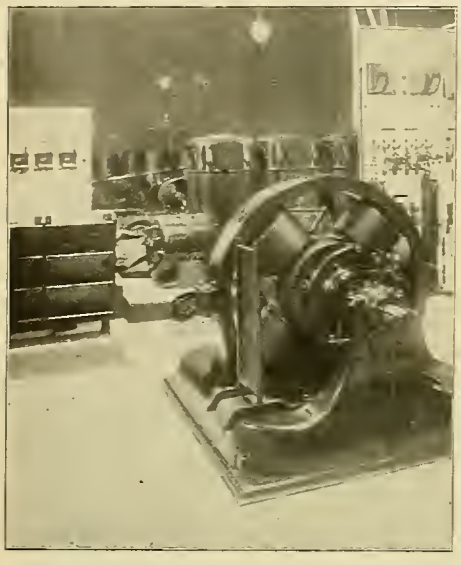


FIG. 2. RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—STATIC TRANSFORMERS AT WABASH AVENUE STATION OF CHICAGO EDISON COMPANY.

connected General Electric multipolar dynamos. Three horizontal compound engines, two of 275 horse power capacity each, and one 150 horse power, are belt-connected to six Edison bipolar dynamos of a total capacity of 500 kilowatts. These generators, which, combined, have a capacity of 900 kilowatts, feed directly into the three-wire systems and are used when occasion demands. Counting the storage-battery capacity as 250 kilowatts, the total capacity of station No. 2 is 2,000 kilowatts.

North Avenue Sub station.

The rotary converters and equipment installed at the North avenue sub-station were planned in the winter of 1898-99. They were originally intended to be installed at station No. 4, at the corner of North Clark and Oak streets, so as to increase its capacity. To get proper distribution from this station a new feeder in the vicinity of North avenue and Larrabee street was necessary. In the meantime the price of copper had advanced so much that it was found that the cost of this feeder would be excessive, and the idea was suggested of establishing a new sub-station in the above-mentioned vicinity, and looping in the old low-tension feeder. Accordingly, a store-room and basement about 20 by 50 feet in size at 346 North avenue was rented, foundations for two rotary converters, three static transformers, two regulators and a switchboard were built, and the sub-station completed about a month ago. The rotary converters are each of 100 kilowatts' capacity at 125 volts, and are of the latest type manufactured by the General Electric company. The three static transformers each have a capacity of 80 kilowatts and are oil-cooled; the two induction regulators each have a capacity of eight kilowatts and are also oil-cooled. The transmission line enters the sub-station overhead from the rear, by means of a pipe taken from near the top of a pole and carried into the building. The overhead line is connected to three lead-covered cables near the top of the pole. Every precaution against danger has been taken. The transmission at present is at 4,500 volts. The static transformers, however, have two primary windings, which may be connected in series and thus give 9,000 volts. The secondaries of these transformers have two entirely independent windings. All of the principal connections at the North avenue station are shown in Fig. 4 (p. 295), while Fig. 5 is a view showing the two converters and switchboard. The transformers and regulators are situated behind the sitchboard.

The North avenue sub-station is operated ordinarily only from about 4 p. m. until midnight. During the remainder of the 24 hours pressure for this portion of the district can be easily maintained from the regular generating station at Oak and Clark streets. The bus-bars of the sub-station swichboard are, therefore, always alive, as the feeder is merely looped through the switchboard. At about 4 p. m. the load begins to increase and the rotary converters are then started up as ordinary direct-current motors. The speed is regulated by adjustment of the field rheostats until the machine is brought up to synchronism; this is determined by means of two phase lamps, shown in Fig. 5, and connected across the terminals of two of the alternating-current switches for each machine. When synchronism has been attained, the alternating-current switches are closed and the machines are ready to take the load. The amount of load on each machine is controlled by induction regulators, and also, to some extent, by adjusting the field strength of the machine. The induction regulators are operated by small three-phase induction motors, and these in turn are controlled by small three-pole, double-throw switches on the face of the switchboard.

If for any reason it becomes necessary, the rotary converters can also be started from the alternating-current end. This is done as follows: The precaution is first taken to see that all field switches are open. The three alternating-current switches are then closed and the machines are started as synchronous motors. The heavy lagging currents tend to magnetize the fields and the machines come up to speed very rapidly. The field switches are then thrown downward, which connects the fields so that the machines are self-excited. The polarity of the machine is then obtained by means of a voltmeter on the switchboard. If the polarity is right the machine can be closed to the direct-current busbars and is ready for load. If the polarity happens to be reversed, the field and main alternating-current switches are opened and again closed before the machine comes to rest, and the polarity again observed. There is an equal chance of the polarity of the machine being right or wrong, when started from the alternating-current end, depending upon the particular conditions that happen to exist at the instant of closing the field switches.

At station No. 5, located at Washington street, there is installed a 250-kilowatt converse-rotary transformer, which takes current from outside busbars of the direct-current system, at from 250 to 300 volts, and delivers an alternating current at 160 volts. By means of three static transformers, this voltage is then raised from 160 to 4,500 volts, and the current is then sent over the line to the North avenue sub-station. The converse-rotary converter is a four-pole machine.

In order to prevent liability of accidents, a special speed-limiting device has been perfected, for use with this machine. This device consists of two coils, in each of which, on a common shaft, is fastened a piece of soft iron at an angle of 45 degrees with each other. One of these coils is connected directly to the direct-current side of the machine; the other coil, in series with a reactance, is connected to the alternating-current side of the machine. At normal speed the forces exerted on these two pieces suffice to balance each other. If, for any reason, the field circuit is accidentally opened or the fields become demagnetized, the machine will, of course, increase in speed, and, as the acceleration is cumulative, the machine would soon fly to pieces. When the machine speeds up, the force exerted by the alternating-current coil overpowers that exerted by the direct-current coil, and closes the circuit through a magnet, which trips the circuit-breaker on the direct-current side of the machine. The connections for this device are shown in the sketch, Fig. 6.

The transmission line connecting station No. 5 and sub-station No. 4 is 14,800 feet long. Twelve thousand feet of this line is underground and the remainder overhead. The underground portion, up to a point opposite station No. 4, is No. 0, three-conductor lead and paper-covered cable. From station No. 4 to Division and Sedgwick streets the transmission line consists of No. 4 three-conductor lead and paper-covered cables. From this point to the sub-station, the line is overhead and consists of three No. 4 weatherproof wires. At each end of the overhead portion lightning arresters are installed; that is, at the sub-station and on the pole where the transmission line is taken underground.

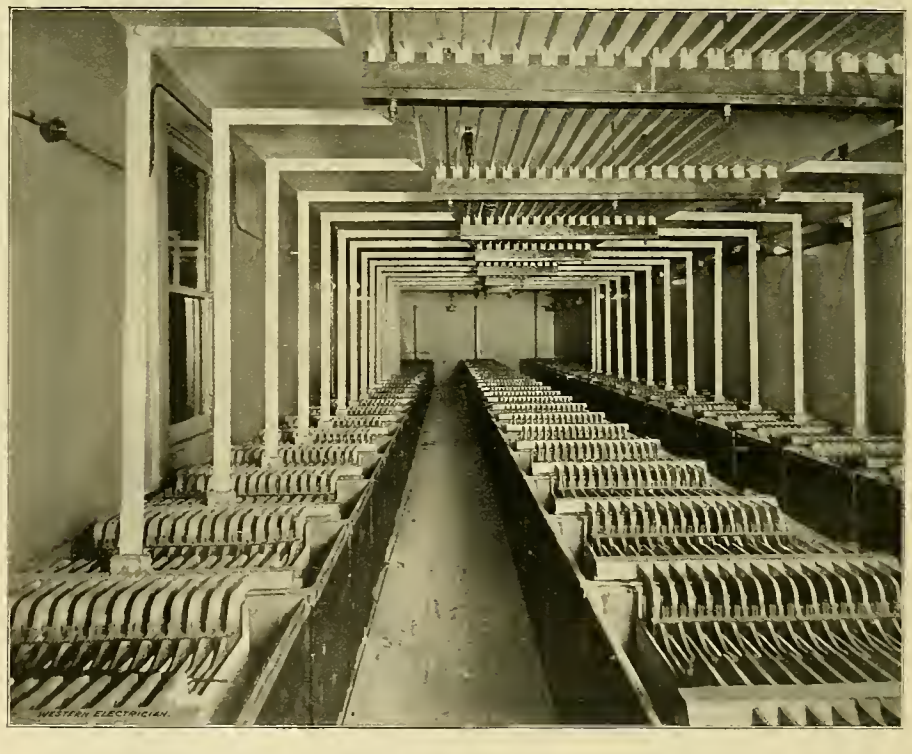


FIG. 3. RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—NEGATIVE STORAGE BATTERY AT WABASH AVENUE STATION OF CHICAGO EDISON COMPANY.

"Minimum Charge" for Electric Light Upheld in New York.

A case of much interest to central-station men was decided by Judge Beekman in New York last month. It seems that Benjamin A. Gould, a customer of the Edison Electric Illuminating company, raised the point that the company had no right to charge him $1.50 a month whether he used any current or not. Mr. Gould refused to pay this minimum charge, although the provision was in the contract. The company thereupon cut off Mr. Gould's light. A suit was then brought by Mr. Gould to compel the company to resume the supply of light to his premises, the action being based on the statute law of the state. The case came before Judge Beekman of the Supreme Court in Special Term. F. W. Longfellow appeared for the plaintiff and Eugene H. Lewis for the electric-light company. The judge decided that the "minimum-charge" clause in the contract was enforcible and found for the defendant company. Following is the text of the opinion, somewhat abridged:

"This action is brought for a mandatory injunction requiring the defendant to reconnect the electric-light appliances in plaintiff's apartments with the conductors of the defendant, and to resume supplying the plaintiff with electric light. Damages to the extent of $500 are also demanded for the refusal of the defendant to comply with plaintiff's demand for such service. An answer has been interposed, which, among others, contains what is described as a second and separate defense to the amended complaint. To this the plaintiff has demurred for insufficiency.

"Without undertaking to state in full the allegations it contains, which are somewhat voluminous, it is sufficient to say that the controversy arises upon the reasonableness of one provision which the defendant requires the plaintiff to assent to as a condition of supplying him with the light desired. This provision was embodied in a paper tendered to the plaintiff for signature, described in the answer as 'the usual and regular application for lighting service of the form and tenor theretofore adopted by the defendant and required of all its customers.' The stipulation in question, quoting from the answer, was that the plaintiff 'would use electric current supplied by defendant for lighting his premises for the period of one year from the time at which connection between the defendant's mains and his premises should be made, and that he would pay for such electric current used by him during each month on presentation of bill at the rate of one cent per hour for each 16 candle

power lamp, or the equivalent thereof, as measured by the meter upon the said premises for the purpose of measuring the current supplied under such application, subject to certain discounts, therein set forth.' It was further provided that 'a minimum monthly charge of one dollar and 50 cents ($1.50) should be made by the company for each separate month during which the agreement should be in effect.'

"It is this last provision which the plaintiff re-

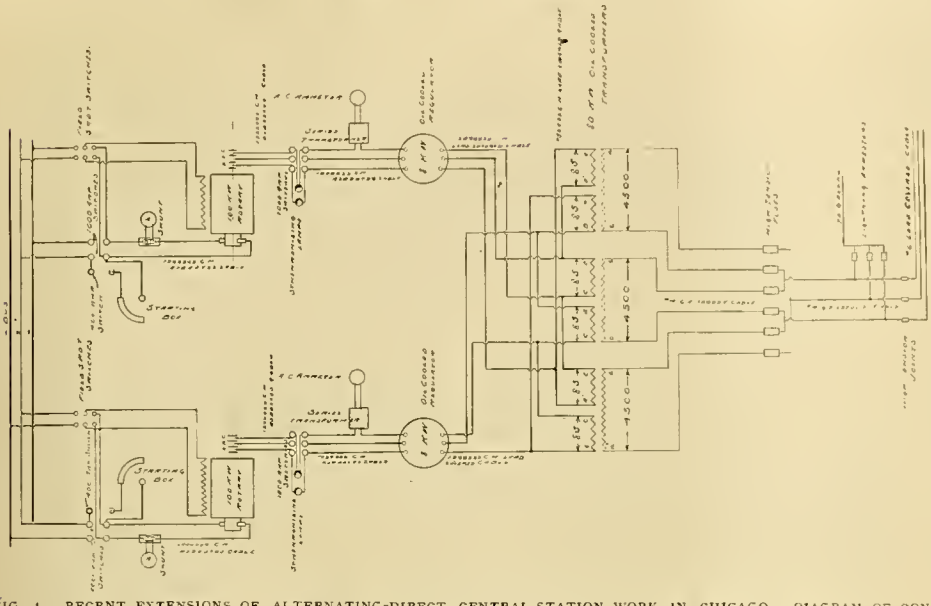


FIG. 4. RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—DIAGRAM OF CONNECTIONS AT NORTH AVENUE SUB-STATION OF CHICAGO EDISON COMPANY.

sists as unreasonable, and, if his contention in that regard is correct, the defendant had no right to require his assent thereto as a condition of performing the legal duty which rests upon it of supplying light when properly demanded. What that duty is is expressed in article 6, section 65 of the 'Transportation Corporations Law' (chap. 566, Laws of 1890), which, among other things, provides that upon application in writing of the owner or occupant of any building or premises within 100 feet of the wires of any electric-light corporation, and the payment by him of all money due from him to such corporation, the latter shall supply electric light as may be required for lighting such building or premises, and that if for the space of 10 days after such application and the deposit, if any be required, of a reasonable sum which the company is entitled to exact as security for the payment of its compensation, the corporation shall refuse or neglect to supply electric light as required, such corporation shall forfeit and pay to the applicant the sum of $10, and the further sum of $5 for every day thereafter during which such refusal or neglect shall continue. It is provided, however, that no such corporation shall be required to lay wires necessary to comply with such an application where the ground in which the same is required to be laid shall be frozen or shall otherwise present serious obstacles to laying the same, nor unless the applicant, if required, shall deposit in advance with the corporation a sum of money sufficient to pay the cost of his portion of the wire required to be laid and the expense of laying such portion.

"It will be observed that the Legislature has not undertaken to regulate the price at which such light shall be supplied, nor to limit or define what

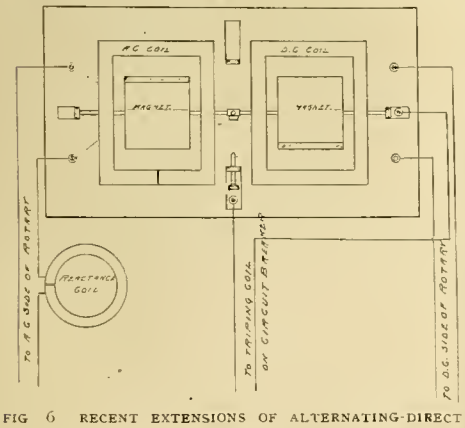


FIG 6 RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—CONNECTIONS OF SPEED-LIMITING DEVICE AT WASHINGTON STREET STATION OF CHICAGO EDISON COMPANY.

compensation the corporation may exact for the service rendered by it. In that regard it is under no legal restraint, except that its charges must be reasonable and uniform. Whether in a given case they are so or not is a proper subject for inquiry and determination by the court, in view of the quasi-public nature of the business and the duty toward the public imposed by law upon the corporation (Lough v. Outerbridge, 143 N. Y., 271, 277). The statute recognizes the right to charge for light consumed, the cost and expense of laying wires and a rental for wire and apparatus (Transportation Corporations Law, article 6, sections 66 and 68); but it does not assume to say what may or may not be reserved for either, nor does it require the amount charged to be separated into items with respect to its constituent elements. The law does not contemplate that the defendant shall do business at a loss. It is expected that it will, and it is entitled to make a reasonable profit upon its venture, and the sole question in such a case as this is whether the charge made is unreasonable, considering all that the defendant is required to do to meet each customer's demand. It is stated in the fourth paragraph of the defense demurred to that the current is generated by dynamos driven by steam engines supplied with steam from boilers, all located in a station building, and when generated is transmitted directly to the defendant's underground conductors leading to the premises of the consumer; that each additional lamp connected with defendant's system necessitates an additional investment by it in distributing conductors and local appliances of about $20 in addition to the cost of generating and delivering the electric current; that the number of lamps which the plaintiff desired was 11, and that the total additional investment thus made necessary in order to comply with his demand for service was at least the sum of $220. How, then, can it be said that a fixed charge not based upon actual consumption is of itself improper or unreasonable? The customer does not bind himself to use any particular amount of light, so that the return to the company, based on actual consumption, would rest entirely upon his volition, and it would therefore depend upon him whether the service he has required the corporation to be in constant and immediate readiness to render is profitable or unprofitable to the latter. But this constant condition of readiness is a necessary and unavoidable obligation which must be sustained in order to meet instantaneously the demand for light which the consumer is entitled to have at any moment that he wishes it. It thus forms a part of the service to be rendered and is an item properly to be considered when the reasonableness of the charges exacted by the company is called in question. As we have seen, the latter is not confined by statute to any specific rate, nor has any attempt been made to measure or limit the compensation which such corporations may lawfully charge, as has been done in the case of gas companies, so that they are free to exact a reasonable return for the service required, which includes, as I have said, not only the actual supply of electric light, but the readiness to supply it coincidentally with the customer's desire to have it. The only condition affecting the right is that the compensation must be reasonable and, what is also incidental to this requirement, that it should be uniform, namely, the same for all customers similarly situated. Undoubtedly, the demand which those desiring to use it are entitled to make for electric light imports an intention on their part to consume it to some extent, and that each lamp ordered is requisite for that purpose. The charge which the defendant makes is based primarily upon actual consumption over which it has no control. One consumer with the same number of lamps will use more than another. In both cases the return to the company may be remunerative, or the use of one may be so inconsiderable as to involve a loss. To meet this contingency the monthly minimum charge of $1.50 is made. But it must be borne in mind that this payment is not in addition to the charge for actual consumption. Where light is consumed which entitles the company to payment, on meter measurement, of a sum per month equal to or in excess of the so-called minimum charge, the customer pays only for the light he has actually had; so that this fixed charge becomes practically operative only where his consumption falls below the extent of use which it measures.

"I can see nothing unreasonable in this when the service, as I have defined it, which the company is obliged to render is considered. It is not a penalty for a failure to use defendant's product, but is properly to be regarded as compensatory for that part of the service which is at all times being rendered in the maintenance of the apparatus and connections through which the electric current is made available to the customer for the production of light at his pleasure. The plaintiff distinctly refused to pay any such charge, and the defendant was therefore justified in refusing to supply him with light. The duty resting upon the company under the statute imports a reciprocal one on the part of the customer to pay for the service which he requires, and where the latter refuses in advance to pay charges which appear to be reasonable, the company is under no obligation to render the service demanded. As the defense in question is sufficient upon its face, it follows that the demurrer thereto must be overruled."

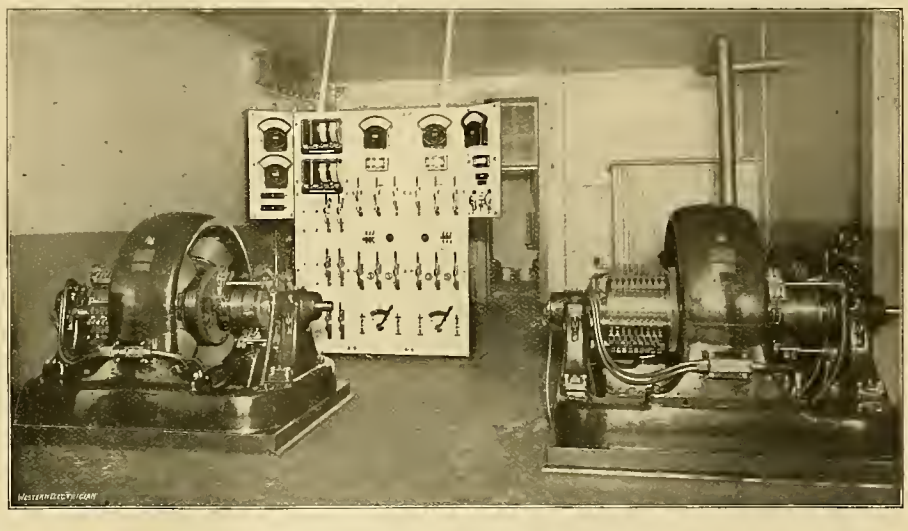


FIG. 5. RECENT EXTENSIONS OF ALTERNATING-DIRECT CENTRAL-STATION WORK IN CHICAGO.—NORTH AVENUE SUB-STATION OF CHICAGO EDISON COMPANY.

Exports of Electrical Apparatus.

The growing popularity of American electrical machinery in foreign markets is indicated by the export tables prepared by the Treasury Department. For instance, the exports in this line (according to the department classification) during the month of September amounted in value to $262,689, an increase of $50,776 over the exports for the corresponding month of last year. For the nine months ended September last the exports were valued at $2,090,737, as compared with a value of $1,625,650 for the same period of 1898.

Even more striking are the figures for the fiscal year ended June 30, 1899. During this period the exports reached a total valuation of $2,736,110, as against $2,052,564 for the preceding fiscal year.

Instruments and apparatus for scientific purposes, under which head are included telegraph, telephone and other electrical apparatus, also show very large gains, the value of the exports for the fiscal year just ended being $4,399,180, as against $2,770,803 for the fiscal year of 1898.

Artificial Coal in Germany.[1]

By P. J. Osterhaus.

I have seen the representative of Mr. George Montag, the inventor of an artificial coal, for which he has applied for letters-patent in a number of states. On invitation, I assisted at a trial to demonstrate the combustive properties of the article and observed its ready inflammability and its apparently considerable heating qualities.

Mr. Montag claims that all sorts of earth may be used for his substitute, with the exception of sand and gravel; but I think that only those whose component parts are vegetable or ligneous, as moor, peat and turf lands, would be available. The inventor also enumerates among suitable substances various kinds of clay, but I believe, with a mental reservation, to use these as an admixture with the vegetable soil, for graduating the heating qualities of the coal.

Certain ingredients are mixed with the earth and worked into a homogeneous mass for the purpose of making it inflammable. These ingredients are the inventor's secret; but since his preparation is intended to have the properties of pit coal, their nature can be easily guessed. They are to take the place and produce the effect of the bitumen of the mineral article and must be substances of quick ignition and combustibility, such as pitch, resin, naphtha or similar products. One hundred kilograms (220 pounds) of such articles may be bought at Mannheim for about $2; but only six to eight per cent. are required for 50 kilograms (110 pounds) of the artificial coal. Including labor and general expenses, the cost for this quantity would be, say, seven cents. A tract of land bought lately by Mr. Montag furnishes 50 kilograms of earth especially suited for the purpose for 0.5 cent, so that 50 kilograms of the artificial coal will cost not more than 7.5 cents to produce. This calculation is taken from the notes of the inventor. The cheapness will be best illustrated by comparing the prices of the various grades of pit coal, which have run in the last year from 17 to 27 cents per 50 kilograms at this place.

The artificial coal, of a grayish black, is pressed in blocks (briquets) of three sizes, viz.: No. 1, 7¼ inches long, 2½ inches broad, 1½ inches thick; No. 2, 6½ inches long, four inches broad, 1½ inches thick; No. 3, 3¾ inches long, three inches broad, 1½ inches thick. The blocks are hard and brittle, and when thrown into the furnace, whole or in pieces, they ignite readily and burn briskly.

The suggestion that for technical establishments blocks of larger size would be desirable was answered with the statement that forms for making 10-pound pieces were already in preparation.

The result of an examination of the Montag coal by the technical assayers at Carlsruhe showed that it contained:

	Per cent.
Water	14.79
Ashes	17.73
Combustible substance	67.48

The heat produced is stated at 5,716 calories. It would appear from this that the application of the invention is not yet perfect, and that in mixing the different earths great care must be taken to prevent working in too large a proportion of useless substances.

The ashes apparently contain a great deal of clayish substance; they are excellent to retain heat, but ineffective for producing it.

Electricity in Advertising.

It is interesting to note the prominence given, pictorially and otherwise, to electrical apparatus by prominent advertisers of other classes of products. Thus, the group of advertising designs shown herewith is made from three distinct sources and is a

ELECTRICITY IN ADVERTISING.

reproduction of advertisements or parts of advertisements of well-known manufacturers—two of soap products and one of a typewriting machine. And yet in one the arc light is prominent, in another the telephone and in the third the incandescent lamp. The incidental and gratuitous advertising of the electric light and the use of the telephone by these advertisements must be considerable. The arc light is set up as a standard of excellence for comparison; the telephone enables the housewife to do her shopping with ease and dispatch, and the incandescent lamp is more prominent than the typewriting machine. These advertisements, clipped from popular publications almost at random, show the widespread interest in, and high reputation of, the familiar electrical appliances.

1. From advance sheets of U. S. Consular Reports. Mr. Osterhaus is vice-consul at Mannheim.

Gasoline Vehicle Catches Fire.

That there is some danger in the use of gasoline automobiles was shown by an accident in New York last week. Mr. Charles Kranich, who is much interested in self-propelled vehicles, was riding with a friend in a gasoline-motor road wagon. Everything moved smoothly until they reached Mount Morris Park. There they received the first intimation that something was amiss when a small boy shrilly informed them by calling:

"Mister, youse'll be blowed up if youse don't look out! She's on fire!"

Hastily stopping the wagon, Mr. Kranich and his friend jumped out. They found the feed pipe which connects the gasoline from the reservoir leaking, and the flames were extended mushroom-like over the entire bottom of the vehicle. There was imminent danger of the heat causing the main reservoir to explode, and had such been the case it would have probably resulted in the destruction of the machine. Mr. Kranich pluckily turned off the running liquid, but this did not quench the flames, which continued to feed on the gasoline already freed. Rather than abandon his machine to the seeming destruction, Mr. Kranich undertook to blow the flames out. While doing this a valve weakened by the fire blew out and the smaller tank burst. A considerable quantity of the burning gasoline struck him squarely in the face and covered his hands. Mr. Kranich was painfully burned and was sent home.

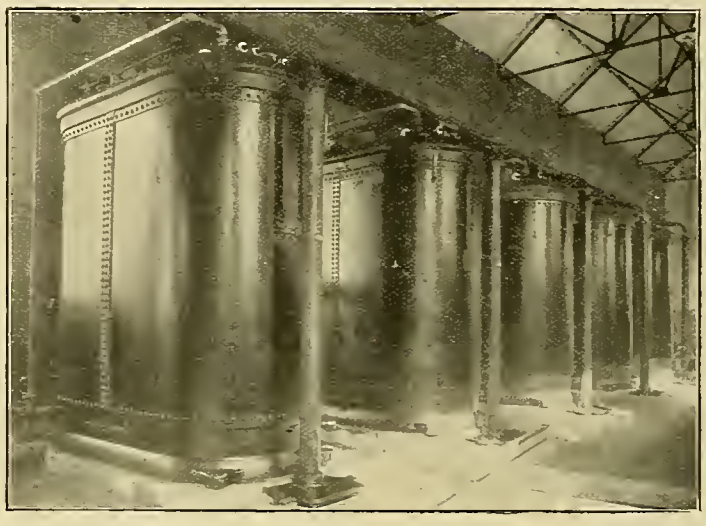
Gratitude to the small boy who gave them the warning was uppermost in the minds of both men. They caused a search to be made for the urchin, but without success. The automobile was not seriously damaged.

Fox River Valley Electric Roads.

Several of the cities and towns in the Fox River Valley, just west of Chicago, are to be connected within a year by a long electric-railway system. When the connecting links are put in and all the new lines constructed, the system will join Aurora, Elgin, Geneva, Batavia to the north and Joliet, Morris and Yorkville to the south, and will then connect these towns with Chicago, via Wheaton and Oak Park. It will cover a total distance of about 120 miles and will traverse five counties, with an aggregate population of more than 200,000 outside of Cook County territory. Four lines, owned by four distinct companies, will form the system in the beginning, though it is possible that they may be absorbed by the company now building the main section between Aurora and Chicago. These companies are the Aurora, Wheaton and Chicago; the Aurora, Yorkville and Morris; the Aurora and Geneva, and the Elgin City, Carpentersville and Aurora Railway companies. The last two named are old lines, having been operated for three years, but there is a gap between Batavia and Geneva which will be bridged shortly, obstructive litigation being practically settled. A 50-year franchise was recently granted in Aurora to the Aurora, Wheaton and Chicago Electric Railway company, which now has the right-of-way for nearly all of its line. Other legal difficulties that have been met are expected to be settled soon, so that the construction work can go rapidly forward. After this system is completed it is expected that the Aurora, Wheaton and Chicago company will build branch roads from Wheaton north as additional feeders.

Largest Transformers in the World.

A contract was recently closed between the Cataract company and the Union Carbide company, both of Niagara Falls, by which the former is to furnish the latter (on the latter's premises) 15,000 horse power at 2,200 volts. It was found that the copper necessary to transmit this amount of energy, at the generator voltage of 2,200, would cost several hundred thousand dollars, though the distance is only 2½ miles. It was then decided to use high-tension transmission, and bids were called for from various companies to supply the necessary transformers to transmit the energy at a potential of 11,000 volts. A contract was closed with the General Electric company to furnish 15,000 horse power transformer capacity, which proves to be cheaper than the cost of the greater amount of copper necessary to transmit at the lower voltage. This fact shows the great advantage of high-potential transmission, even for short distances.



LARGEST TRANSFORMERS IN THE WORLD.

The General Electric company is furnishing seven transformers of 2,500 horse power capacity each, at a frequency of 25 cycles, a primary voltage of 11,000 and a secondary of 2,200. These transformers are by far the largest that have ever been built, the next size smaller being only one-half the capacity, namely, 1,250 horse power.

The total weight of each transformer is 50,000 pounds. This is a good load for a freight car, so that a train of seven cars would be necessary for the transportation of the total order. About 12½ tons of sheet-iron are used in the cores. The coils of the transformers are 6½ feet long by four feet wide, or about the size of an ordinary billiard table. The clamps for holding the sheet-iron core together weigh, approximately, 4,000 pounds, and a steel bar 4½ inches in diameter and nearly four feet long is used for a support when raising the apparatus. Even with this large steel bar, it is necessary to use a space block that will keep a sling in such a position that the strain will come on the bar near the points of support.

Each complete transformer is 11 feet 1¼ inches high, eight feet 7½ inches wide and four feet 4½ inches deep. It cannot be shipped entirely assembled, as the height is too great to pass under railway bridges.

Tests of these transformers give the following results: Iron loss, 22,600 watts; copper loss, 8,700 watts; regulation, one-half per cent.; efficiency, at full load, 98.3 per cent.; at three-quarters load, 98; at one-half load, 97.3; at one-quarter load, 95.3; rise in temperature, after eight hours at full load, 45 degrees Centigrade.

The transformers will run at full speed continuously, so that the copper loss was favored rather than the core loss. They are cooled by use of both water and oil, 650 feet of piping being necessary for each. At an efficiency of 98.3 per cent. it would seem at first sight that the radiation of heat due to the losses would be a small matter. But 1.7 per cent. of 2,500 horse power amounts to over 40 horse power, or enough energy to supply 600 16 candle power incandescent lamps.

The accompanying illustration shows five of the transformers for the Union Carbide company, which are already installed.

Glasgow Contracts.

With Babcock & Wilcox boilers, Allis engines and General Electric generators, the power houses of the new electric-railway system of Glasgow will have a familiar look to the American visitor. In addition, the bid of the National Conduit and Cable company of New York for furnishing and laying the feeder cables has been accepted. This latter contract will amount, it is said, to $750,000. It is also stated that American cars and trucks will be used. It is said that the National Conduit and Cable company agreed to deliver the cable at the rate of 100,000 feet a week for six months.

Standardizing Alternating-current Switchboards.

Of especial interest are the accompanying illustrations, which show the front and rear of an eight-panel switchboard for two-phase circuits erected in the power station of the Valley Electric company of Fallston, Pa., as they represent the standard practice recently adopted by the Westinghouse company for two-phase installations of from 1,100 to 2,200 volts.

The three left-hand panels of Fig. 1 control three two-phase generators running in multiple, the next three panels control three two-phase, four-wire feeders, and the last two panels control four single-phase, two-wire feeders. As additional generators and feeders are added to the plant the switchboard can be enlarged without interrupting the service. Should it be necessary to install extra or special apparatus, panels can be placed in the space below the standard panels. All appliances are mounted directly on the panels, so arranged that no charged metal parts are on the front of the switchboard, thus avoiding accidental shocks.

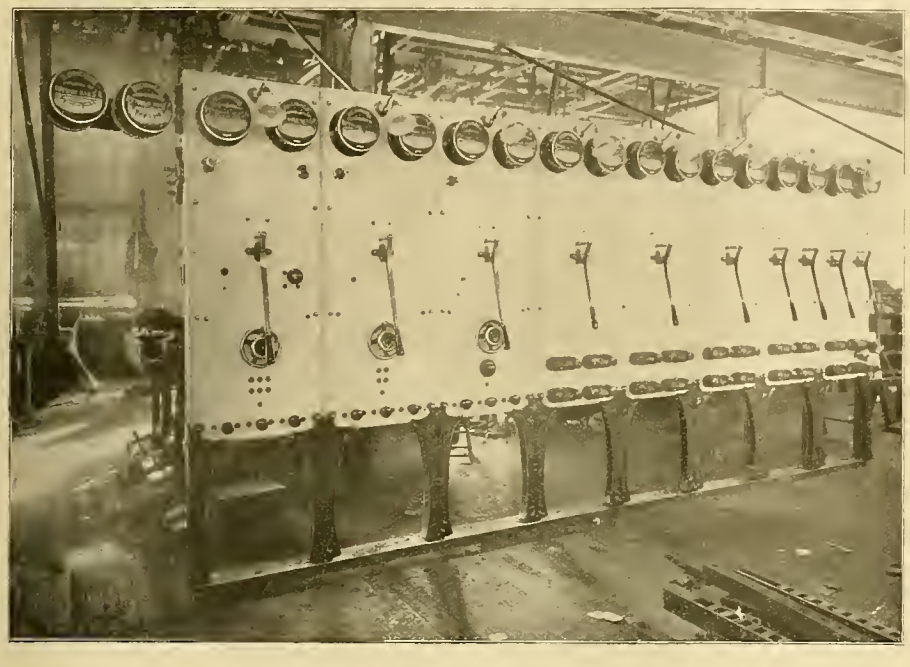


FIG. 1. STANDARDIZING ALTERNATING-CURRENT SWITCHBOARDS.—FRONT VIEW OF BOARD AT FALLSTON, PA

The generator panel at the extreme left in Fig. 1 contains a pilot lamp, two alternating-current ammeters, two keyless sockets and lamps, a four-pole, high-potential, double-break plunger switch, three field plugs (two for the main separately excited alternating-current field and one for the composite field), a combination alternating-current and direct-current rheostat mounting, a ground-detector receptacle and plug, a push button, a synchronizer receptacle and plug, a six-point voltmeter receptacle and plug, three switchboard transformers and transformer fuse holders. The second and third generator panels are equipped very similarly to the first panel, except that there are omitted one keyless socket and lamp, a ground-detector receptacle and plug and push button. A four-point, instead of six-point, voltmeter receptacle is used, and there is only one switchboard transformer and transformer fuse holder, instead of three.

Each of the three two-phase feeder panels to the right of the generator panels contains a pilot lamp, two alternating-current ammeters, one four-pole, high-potential single-break switch and four single-pole fuse holders. The two feeder panels to the extreme right of Fig. 1 each controls two single-phase feeders connected one to each phase of the two-phase bus-bars. They each contain a pilot lamp, two alternating-current ammeters, two two-pole, high-potential, single-break plunger switches and four single-pole fuse holders. Two voltmeters, one connected with the bus-bars and the other to either of the generators, are swung on a bracket to the left of the switchboard, in full view of the operator when handling the switches.

The board described represents the construction usually employed for multiple running of generators, although the Westinghouse company builds various types of standard alternating-current switchboards. For separate running of generators, special feeder panels are added to the switchboard, being so arranged that any feeder can be operated from any generator. The apparatus furnished enables the feeders to be transferred from one generator to another without any perceptible winking of the lights. Any of the standard generator panels may be used for separate running, and, if desired, the main switch may be dispensed with and the generators taken out of service by operating the field circuit by means of the field plugs. High-potential plunger-type switches are used, as they are practically non-combustible. No charged metal parts are exposed on the front of the board, and the construction permits thorough examination of the switch to be easily made from the back. Fuses are mounted in lignum-vitæ fuse holders, enclosed in a chamber which is air-tight, except for one small vent. The melting of a fuse causes a rapid expansion of the air contained in this chamber, and consequently creates a strong and quick air blast through the vent, blowing out the arc. Lignum vitæ, being an extremely heavy, close-grained wood, is not readily burnt by the arc. It has great strength, combined with considerable elasticity; thus the tremendous expansive tendency produced by the arc is properly restrained, while just enough flexibility to avoid rupture is allowed. This type of fuse was developed by the Westinghouse Electric and Manufacturing company as early as the World's Fair installation, and is now generally used for this class of work. Fuse holders are mounted at the bottom of the switchboard, and the vent is so constructed that it discharges fuse vapors downward, toward the floor. The holders are detachable from the board and the fuses may be renewed most conveniently and without danger.

Alternating-current, generator-field rheostats are mounted on the back of the generator panel and are so designed that the exciter rheostat can be placed within them if desired. Both rheostats are independently operated by concentric hand wheels on the front of the board. In the case of very large machines, the face plate only is on the switchboard, the rheostat being placed in any convenient place and connected to the face plate by insulated wires.

Regulators for single-phase feeders may be mounted directly below the feeder panels. For a two-phase feeder panel the regulator is not mounted on the board, but it is a separate piece of apparatus placed directly in front of the feeder panel to which it belongs.

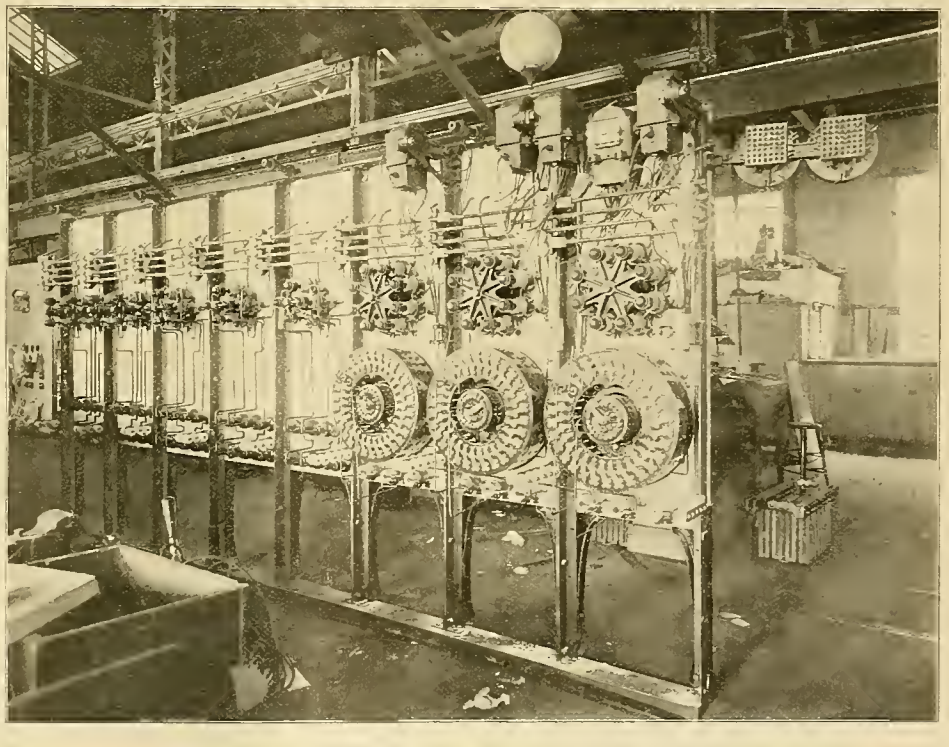


FIG 2. STANDARDIZING ALTERNATING-CURRENT SWITCHBOARDS.—REAR VIEW OF BOARD AT FALLSTON, PA.

Successful Tests of the Holland Submarine Boat.

The Board of Inspection and Survey of the Navy Department supervised the final tests of the Holland submarine torpedo boat last week, and every member of the board declared the boat a success. Little Peconic Bay, on the Long Island coast, was the scene of the tests, which took place pursuant to instructions issued by the board. The course, a mile in length, was marked by flags and was covered during the first run by the boat submerged in eight feet of water in nine minutes. At the end of the course she rose, discharged a torpedo and then, turning within two lengths, returned over the mile course in 11 minutes. During the next trial a torpedo was discharged while the boat was below the surface. In a test for speed the little vessel developed eight knots an hour. The members of the board seemed very much pleased with the tests, and all congratulated the inventor, John P. Holland, on his success. It is confidently expected that the report of the board will be a favorable one and that Rear-admiral Hichborn will recommend to Secretary Long not only the purchase of the boat, but also the building of three like her next year. The boat will start soon for Washington, by way of Delaware City, the Delaware Canal and Chesapeake River, and will be placed where she will be convenient for the inspection of members of Congress. The Holland boat is driven by storage batteries and an electric motor when submerged.

Large New Railway Power Plant in St. Louis.

The United Railways company of St. Louis, Mo., which recently secured control of all the street railways in that city, is building a new power house, which, with other improvements the company is making, will entail an expenditure of $6,000,000. The contract for the electrical equipment of the power house has been given to the General Electric company. It includes two 2,250-kilowatt standard railway generators, a 500-kilowatt machine and one of 425 kilowatts. These four machines are all direct-current. There are also two 1,200-kilowatt, 1,600-volt, alternating-current generators. The alternating current will be transmitted to a sub-station, where it will be converted to direct current by four 600-kilowatt rotary converters, which the General Electric company will also supply.

The Medfield and Medway (Mass.) Street Railway company has been incorporated, with a capital stock of $50,000, to construct an electric railway from the terminus of the lines of the Norfolk Western street railway in Medfield, through Millis to Village and Sanford streets, Medway, a distance of seven miles. The directors of the company are W. W. Mitchell, J. J. Feeley, H. L. Howard, R. G. Fairbanks, C. M. Bates and A. C. Smith.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, = CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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After several contradictory reports, it is now officially announced that the United States cable-ship Hooker, wrecked off Corregidor last summer, cannot be saved, although the cargo will not be lost. It is a pity that the first American cable-ship should make such an unfortunate end, although the disaster was the result of an error of the navigator and in no way due to the special use to which the ship was to be put.

Lord Kelvin's successor in the chair of natural philosophy at Glasgow University, Prof. Andrew Gray, delivered his introductory address last month. He alluded to the magnitude and difficulty of his task, for he knew, he said, that the work of his illustrious predecessor would tax the powers even of the greatest and ablest of living cultivators of science. He showed his high appreciation of the value of scientific research in advancing industrial accomplishment by referring to the large factories and workshops of Glasgow as "great laboratories of applied science." The expression indicates, in a rather striking way, that the scientist of to-day knows and takes his preëminent position in the march of material progress.

American advocates of municipal ownership often point to the number of municipally managed enterprises in Great Britain to support their argument; but it happens that many Englishmen have become alarmed at the extent of municipal trading, as it has been called, and the matter may be brought up at the next session of Parliament. It is complained that individual effort in England is being crushed and enterprise stifled by municipal interference; that unless a vigorous opposition is organized against these encroachments of the municipality the national consciousness will be stifled by bureaucracy, as it has been so largely in Germany. It is asserted that the electrical industry, for instance, would be in a much more forward state in the United Kingdom if it were not for the dog-in-the-manger policy of many municipalities, which restrain private capital from embarking in electric-lighting or railway enterprises, while doing little or nothing themselves to carry their powers (obtained by "provisional orders" granted by Parliament) into effect. However, municipal trading has been carried to such an extent—although not, as has been explained, to the great benefit of electrical manufacturers—that local indebtedness and taxation have greatly increased. It is said that municipal debts in England and Wales more than doubled in amount between 1878 and 1897, and this fact is one of the immediate causes of alarm. Other objections to the municipalization craze are the organized efforts, in opposition to private enterprise, of the Municipal association, which is said to maintain a well-equipped lobby at Westminster; the difficulties in the ay of building light electric railways between municipalities, and the demoralizing political effect on the employes of the city-trading works, very many of whom are voters. These reasons have induced not a few Englishmen to question the soundness of the municipal-trading idea, and there is some possibility that the whole subject may form the basis of a parliamentary inquiry.

Telephone men will find much to interest them in the arguments of counsel in the Berliner infringement suit, which, at this writing, is still on trial in Boston. Abstracts of the lawyers' pleas are presented on another page and give a clear idea of the trend of the arguments, although, of course, the long disputations of the attorneys are greatly abridged. The case is fraught with great importance to telephone makers, operators and users the whole country over, as has been previously pointed out in the Western Electrician. It is attracting some attention in the daily press, but not so much as its consequence would warrant. Perhaps this neglect is due to the technical nature of the suit, although the main features of the case are simple enough and of obvious importance. We note, however, a long and, on the whole, excellent article in the New York Sun of November 12th, entitled "Mighty Telephone War," in which the history of the telephone, the Independent movement and the Berliner case is reviewed. The Sun rather misses, however, the point that a favorable decision is more vital to the Bell people than to the Independents. It says: "This contest, too, is looked upon as the last that will be made, either to establish or to break the validity of the claims under which the American Bell Telephone company has built up and now holds its great and remunerative collection of business enterprises. Should the suit for infringement brought against the National Telephone Manufacturing company fail, it will throw the entire telephone field open, without material restriction, to the Independent operators, who have already established themselves and covered a large part of the country with their telephone wires and exchanges. Should the American Bell Telephone company win, these Independent operations would receive a serious check. In fact, there would then be a strong possibility that they would fall into the hands of the Bell company, just as many another company has that attempted competition."

We believe that the extent of the check to the Independents by an ultimate decision upholding the Berliner patent is here greatly overestimated. The Berliner patent does not cover the art of electrically transmitting speech, and we have no doubt that perfectly feasible and satisfactory telephone communcation will be provided by other than Bell licensees, even if the patent in suit is held to be valid by the court of last resort. It is not to be believed that the United States of America will again sink into the grasp of an odious telephone monopoly. Indeed, as the Sun itself shows, in another part of its article, the Independents are not the men to surrender meekly to the prestige and influence of the Bell people. To quote again from the article mentioned: "The Bell company, at best, was never decidedly popular with its patrons and the people, and when a chance came for breaking away from it the people gave hearty welcome to competitors. The Bell company at this time owned many patents on exchange switchboards and other telephone apparatus and relied upon these to keep down serious competition, as well as upon reëstablishing the validity of the Berliner patent; but new connections not only enabled the Independent companies to do without the Bell company's patented articles, but proved themselves in many cases so superior that the older concern was obliged to set its experts at work briskly to keep up with the procession." And why may not a similar result be expected if the Berliner patent is upheld? That patent will then be a very valuable one, no doubt; it may put the anti-Bell people to considerable trouble; but it is not the whole art of telephony, by a long row of apple-trees.

The electric-lighting industry seems to be prospering in London, for the Metropolitan Electric Supply company, the largest central-station concern in the English metropolis, is obliged to issue a circular explaining its inability to supply sufficient current to meet the demands of consumers at times of heavy load. "Anticipating a considerable growth of business, the directors commenced the erection of new generating works at Willesden two years ago," says the company. "These works, the largest of their kind in Europe, have been fitted up with machinery of unusual magnitude and of the most modern construction; but owing to unforeseen delays in the delivery of constructional and other ironwork, the works have only just been completed. When it was found that this delay might prejudicially affect a portion of the general supply, arrangements were made for obtaining temporary help from a neighboring undertaking, but latterly this assistance has unfortunately failed us, and our resources have been unduly taxed. The machinery and connections at Willesden are now in course of adjustment and trial runs are being continually made. The results of these trials justify the directors in feeling confident that they have to ask for the indulgence of consumers for a short time only."

This announcement is of much interest, for the "machinery of unusual magnitude and of the most modern construction" referred to by the Metropolitan company is undoubtedly the plant built at Pittsburg by the Westinghouse people for this company. The order consisted of three 2,500 horse power, two-phase generators, direct-connected to three vertical, compound, marine-type engines. The sets are so designed that full output may be obtained at any speed from 116 to 145 revolutions a minute, this range of speed being necessary in order to provide a variation in the frequency of the alternations, and thus enabling a supply to be given to existing transformers in London. The armature of each unit is coupled direct to the engine shaft, but engine and generator are mounted on separate bedplates. The two-phase currents have an electromotive force of 500 volts. One exciter, directly connected to the engine shaft, is provided for each generator.

The plant is to furnish current, primarily, for direct arc and incandescent lighting, but a portion of the power will probably be used to operate rotary transformers to supply current to direct-current motors and storage batteries. It was noted at the time this machinery was built that while it was no novelty for England to send to the United States for electrical apparatus, it was a new circumstance for America to sell in England steam engines of such large size. But within the last two or three years quite a number of large American engines have been ordered for British plants, principally for street-railway operation.

Transformers for Series Arc-light Circuits.

In a patent granted to Waldo A. Layman and Ferdinand Schwedtmann of St. Louis on October 31st and illustrated and briefly noticed in the Western Electrician's patent department last week, there is a contribution of some importance on the vexed subject of operating series arc lamps on alternating-current circuits. The patent is entitled "Means for Regulating Constant-potential Transformers," and covers what is said to be an improved method in means for maintaining a constant current in an alternating-current circuit of varying resistance from the windings of a constant-potential transformer fed from a constant-potential dynamo. The invention is particularly designed for use in operating alternating-current arc lamps in series. The inventors' statement of the present state of the art, while made to advance their own claims, is nevertheless instructive and is quoted herewith:

"Heretofore arc lamps have been operated with alternating currents in various ways. We will refer to a few of these methods for the purpose of distinguishing our present invention therefrom.

"The first application of alternating currents to arc-lighting systems to which we will refer is that known as the 'constant-potential multiple' system. By this system lamps operating as individual units were run in parallel between low-tension feeders in the same way as incandescent lamps are now generally used where such incandescent lamps are used for commercial lighting. The amount of current taken by each arc lamp in this system is regulated by mechanism located inside of the lamp itself or by this mechanism in conjunction with auxiliary resistance or reactance, and the general practice is to supply to the circuit a constant potential. Where these lamps are not fed from a low-potential circuit, it is necessary to introduce a step-down constant-potential transformer between a set of high-tension circuit-wires. The high-tension wires above referred to take the place of the low-tension circuit, and in this event the general plan of operation is the same, with the exception that the lamp is supplied with the proper energy required by the interposition of a reduction transformer between the lamp and the circuit.

"Another system is the arrangement of the arc lamps in series, the circuit containing these lamps being fed from the secondary of a constant-potential transformer fed by a constant-potential dynamo. In this arrangement the control of current flowing in the circuit is effected by means of regulating resistance or inductances in either the primary or secondary circuits. As is well known, the condition of an arc-lighting series circuit is a very unstable one, many causes entering to make the effective resistance of the circuit a widely varying quantity. By reason of this wide variation in the resistance of this circuit, the variation of the current (providing that the potential supply is constant), is as great as is the variation of the resistance The successful operation of the circuit, however, is dependent on the maintenance of the current flowing at a constant value. Manual regulation of the switchboard is therefore resorted to to procure this constant value, which requires the attention of a skilled electrician, whose duties are to plug in or plug out, as the circuit demands. The circuit being thus dependent upon the strict attention to duty on the part of the attendant, it will be seen that very wide irregularities in the operation of the circuit might easily arise. Further than this, serious consequences might follow from these variations in that the partial or possibly the total destruction by burning out might result not only to the lamps, but to the transformer feeding the circuit, with the further objectionable result of a very wide variation of the current demand upon the dynamo. These variations are sometimes so sudden and of such wide range as to render the manual manipulation of the switchboard impossible with respect to the control thereof by the attendant within safe points.

"Another system for the use of alternating arc lamps in series makes use of what is known as a 'constant-current transformer,' operating on a constant-potential circuit. This transformer is so constructed as to furnish a constant secondary current through the medium of the automatic introduction of a large magnetic leakage in the transformer; that is, the transformer is so constructed as to limit the amount of magnetic lines of force which will effectively thread themselves through the secondary circuit. Transformers may be constructed to accomplish this end in several ways, and it is not deemed necessary to explain the same here, and such transformers can, if built properly, effectually maintain practically constant current in the lamp circuit within wide limits. In doing this they answer the practical requirements, and did they not involve certain objectionable features, outside of the lamp circuit, would be a very satisfactory solution of the problem. We will refer to a few of the important objections to this system:

"First—The so-called 'power factor' of the current which such a transformer as this draws from the dynamo is low at practically all times, decreasing in value with the amount of magnetic leakage. It is at its best value when the arc circuit feeding from the secondary is operative under normal conditions, for which this immediate system was designed. Should for any reason the resistance of the arc circuit fall below the normal value, the consequence will be an increase of the magnetic leakage in the transformer and a consequent decrease of the power factor of the current supplied by the dynamo. It is detrimental to the satisfactory pressure regulation of an alternating dynamo to have a current of low power factor taken from the dynamo in so far as the dynamo is concerned, chiefly by the fact that it becomes difficult to maintain a constant pressure at the brushes, and, further, that the capacity of an average alternating-current dynamo is very much decreased under such conditions. In other words, it is possible to operate an alternating-current dynamo in extreme cases with 50 per cent. more load when the power factor is high than can be accomplished when the power factor is low, and therefore it is of great advantage to the central stations to have the power factor of their service as high as possible. If the pressure regulation of the dynamo is poor by reason of a variable and low power factor of the current taken from it, it becomes disadvantageous to operate incandescent lamps from the same dynamo, as it is well known that incandescent lamps operate efficiently and with long life only when the pressure of the current subjected to them is maintained practically constant.

"Second—The ratio of current in the primary winding in the transformer to the current in the secondary winding of the transformer remains practically constant regardless of the condition of the arc-light circuit external of the transformer; that is, it matters not as to the amount of current flowing through the windings of the transformer whether there be one-half or all of the lamps of the arc circuit in effective operation. The result of this feature of the transformer is that the waste of energy in the copper windings thereof is practically a constant quantity, regardless of the amount of effective work which is being done in the external secondary circuit thereof, and therefore the energy losses in the transformer are practically constant at all times. The fact that there exists in such a transformer the feature of the amount of current being always constant contributes to the increased reaction upon the dynamo itself; that is, the effect of the decrease of power factor of the current taken from the dynamo upon the regulation of the dynamo is worse when little work is being done in the arc-light circuits than when a great amount of work is being done. If a small amount of work were done in the circuit and the amount of current taken from the dynamo were decreased proportionately, the effect on the dynamo would not be so serious, even did the power factor of the lessened current decrease. As it is, however, there is the double effect of the current demand remaining large when the work being done is small and the power factor decreasing with the same amount of current when the work being done is small.

"In our system the power factor remains constant at practically all loads and at a high value, while the demand of current from the dynamo bears an almost constant ratio to the amount of work being done in the arc-light circuit.

"Another system has made use of a constant-potential transformer with an external resistance or reactance automatically governed. Where resistance is used, a high power factor is always maintained but the loss, or, rather, the power consumed by the system, is always the maximum energy required for the whole circuit; that is, if the effective circuit of arc lamps does not require the maximum energy by reason of several lamps being temporarily or otherwise removed from the circuit, the energy which these removed lamps from the circuit require is taken up in the auxiliary resistance. Such a system is highly inefficient. Where a reactance is inserted, it accomplishes practically the same thing within the transformer, and with all the attendant objectionable features of a constant-current transformer above referred to.

"Our invention therefore consists in the use of a constant-potential transformer, the winding thereof being built in steps. We introduce automatically controlled regulating devices which vary the amount of winding of the transformer in actual use in proportion to the requirements of the circuit. This automatic controlling device is so arranged that the current which flows in the winding of any and all such portions in actual use will be maintained practically (so far as the secondary is concerned) constant, being the amount required for the operation of the external arc-lighting circuit or other circuit. It is well known that a constant-potential transformer gives out from its secondary in energy the same amount within a small per cent. as is supplied to the primary in energy. The amount of energy, real or apparent, in either primary or secondary circuit is proportionate to the product of the pressure of the current in both cases. It is our intention to take from the secondary a constant current, and therefore the amount of energy which we draw from the secondary will be proportionate to the pressure which we require to use, and the amount of such pressure will be immediately in proportion to the number of steps of the secondary winding of which we make effective use. The total demand of energy from the dynamo will thereby be proportioned to the amount of pressure which we take from the secondary circuit. Since the secondary current is constant and since the primary pressure is constant, it follows that the amount of current which we take from the dynamo will be proportionate to the amount of pressure made use of on the secondary side of the transformer. It is well known that a transformer constructed for a constant-pressure reduction is one in which the power factor of the current in the primary circuit is practically the same as the power factor of the current in its secondary circuit. This being the case, the power factor of the current supply taken from the dynamo will, with our arrangement, be the power factor of the current flowing in the arc-lighting circuit. It is also well known that the power factor of an arc lamp, where inductances or reaction coils are not introduced, is relatively high, being approximately .85 to .90. If we introduce no auxiliary reactance coil or other form of auxiliary resistance devices, the power factor of the current taken from our transformer will be practically .85 to .90, and therefore the power factor of the current taken from the dynamo will be substantially the same; that is, .85 to .90, and will be practically constant for all conditions of resistance in the secondary circuit, since the only variation of resistance in the arc-lighting circuit will arise from the cutting in or cutting out of lamps.

"To sum up, briefly, the advantages accomplished by the use of our system, we may recapitulate as follows:

"First—The current drawn from the dynamo always has a high power factor and is in proportion to the number of lamps burning in the arc circuit.

"Second—The arc circuit is at its maximum efficiency if we introduce no resistance to take the place of lamps which temporarily or otherwise are cut out of the circuit.

"Third—The transformer is at its maximum efficiency as the losses therein are in a measure proportionate to the effective work being done in the circuit."

Cable-cutting Question Still Unsettled.

At the general meeting of the Cuba Submarine Telegraph company in London last month, the chairman of the board of directors, Mr. C. W. Parish, made the customary statement, in which these interesting passages occurred:

"The last item on the credit side of the balance sheet is repairs to cables, etc., damaged during Spanish-American war, £8,084, and which, for the present, we are keeping in the form of a suspense account. As mentioned in the report, we are communicating with the Foreign Office as to our claim for compensation for this damage, and the matter is being laid before the United States government. The question of our concessions being formally recognized by the United States government is still unsettled, and I think a good deal must depend upon what the American policy with regard to Cuba will be. You probably have heard reports that the Americans have no desire to remain in the island any longer than is absolutely necessary, while others refer to a prolonged occupation.

"When I had the pleasure of addressing you in April last I said: 'I would like to put on record that we are of opinion that the Spanish government has treated us very fairly, and I have every expectation that we shall eventually receive the amount at present outstanding, but until it is actually encashed we prefer to leave it out of the receipts, although we have now practically agreed on the amount with the government;' and now, gentlemen, I have the satisfaction of telling you that my forecast was not misplaced. The accounts extended over several months of the war period, and it was unfortunate that the Spanish authorities had to leave Cuba before they were settled; but copies were sent to us here, and we thought it advisable that Mr. Keith and Mr. Scott should go to Madrid and explain the whole matter to the government officials. They were kindly received and in a few days the account was settled; and the present half-year's receipts will benefit by some £5,000 or £6,000, which they encashed."

Street Railways in Connecticut.

The annual report of the returns made by the 29 street railways in the state of Connecticut has just been completed by the railroad commissioners of that state and has been made public. The report shows a healthy condition in all the roads and a remarkably good showing of net earnings for the year. There are, according to an abstract of the report in the New York Tribune, four street railroads in the state whose net earnings are over $100,000, six with net earnings over $50,000 and 11 over $25,000. Ten show gross earnings of over $100,000 for the year. Of the 29 street railroads 15 pay dividends, and of these seven paid over $25,000 out to the stockholders. The total capital stock of the street railroads in the state is $12,620,940; the bonds issued, $10,000,000; the floating indebtedness, $13,000,000; the cost of construction, $9,500,000; the equipment, $2,600,000; the gross earnings, $3,200,000; the net earnings, $1,200,000, and the dividends, $343,100. The total trackage of the state street railways is 496 miles, and of this 230 is owned by four companies, in Bridgeport, Hartford and New Haven. The largest company in the state is the Fair Haven and Westville of New Haven, which owns a trackage of 84 miles, has a capital stock of $2,900,000, and net earnings for the year of $183,000 and dividends of $104,000. The next largest is the Hartford street railway, which has a trackage of 62 miles, net earnings of $180,900 and dividends of $42,000.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Berliner Case.

[From the Boston correspondent of the Western Electrician.]

Boston, November 14.—The hearing that has been in progress during the last week in the United States Circuit Court, District of Massachusetts, equity session, relates to two suits, and incidentally interests a third party that joins forces with the defense to oppose the claims of the American Bell Telephone company.

The two suits definitely specified are numbered 653 and 655. The former is against the National Telephone Manufacturing company and the latter against the Century Telephone company. The complaint is substantially the same in each instance, and the entire matter is heard as one case. By leave, also, Judge Robert S. Taylor appears as counsel in the interest of the Williams Electric company of Cleveland, O.

Judge A. L. Brown, before whom the arguments of eminent counsel on both sides have been presented, is an attentive listener. The brief for the complainant, prepared by Frederic H. Betts, Frederick P. Fish, George L. Roberts, W. W. Swan and W. K. Richardson, and presented by Mr. Fish, contains upward of 250 printed pages, and the rejoinder of the National Telephone Manufacturing company, as set forth by the brief of Edward P. Payson, counsel for that corporation, is almost equally bulky. J. E. Maynadier submitted the brief for the Century company, and was followed by Judge Taylor. Mr. Betts closed for the complainant.

Mr. Fish's Plea.

Attorney Fish's plea occupied most of the time on Tuesday, November 7th, the opening day, and continued through the greater part of Wednesday. In his preliminary statements he set forth that the two suits to which his arguments would apply were brought by bills in equity, alleging infringement of letters-patent of the United States No. 463,569, dated November 17, 1891, and issued to the complainant as assignee of Emile Berliner.

"The only substantial issues made by the defendants in these cases," said he, "are as to the validity of the claims in issue of the Berliner patent. Both defendants contend that the Berliner patent of 1891 was invalid because of the issue to Berliner on November 2, 1880, of patent No. 233,969, which was issued for the Berliner receiver, as a division of his patent here in suit. This is the only defense which is advanced in the testimony of the Century company's expert, although we understand that this company may join in the defenses set up by the National company.

"The National company contends that Berliner's patent in suit is limited in term by the issue to him in 1880 of various foreign patents (now expired) for sundry small improvements on his broad microphone invention, the subject of the patent in suit. These foreign patents correspond with various United States patents for such improvements which were applied for by him two or three years after his application for the patent in suit.

"The National company contends that Berliner's application, as originally filed, was unlawfully amended. But we show by an analysis of the proceedings preliminary to the grant of this patent that the amendments made by Berliner were such as are clearly permissible, and, indeed, prescribed by the statutes.

"The National company contends that the 'Bell liquid transmitter,' briefly referred to in Mr. Bell's great telephone patent of 1876, was a microphone and anticipated Berliner. This instrument has been well known as an early experiment since 1876, but nobody ever thought of its being a microphone until the suggestion was made in 1896 at the final arguments of the government suit, and there is no merit in the argument.

"The National company contends that Berliner was anticipated by Edison as the inventor of the microphone, but Mr. Edison himself never advanced any claim to the microphone, although he was diligent in applying for patents on telephone improvements; and an analysis of his crude sketches and early experimental work will show that there is nothing therein which anticipates Berliner.

"Upon the question of infringement there is probably no contest. The defendants' telephones were clearly described by Professor Cross of the Massachusetts Institute of Technology, in his opening deposition; and nobody has disputed his statement that if Berliner's claims are valid they are infringed.

"Berliner's patented invention is described in his specification as 'a new and useful improvement in transmitters for electrically transmitting sound of any kind,' and can be best understood after a brief reference to the prior art.

"The Supreme Court considered the Reis instrument at length in the telephone cases, and found expressly that 'Reis discovered how to reproduce musical tones, and he did no more. He could sing through his apparatus, but he could not talk.'

"Bell devised an instrument to transmit speech, which produced what is known as 'Bell's undulatory current.' But there was a defect in this transmitter. Professor Cross says: 'The apparatus of Mr. Bell was exceedingly perfect, both in its theory and in the practical results which were reached by it. But the currents produced by the transmitter were extremely feeble.'

"Berliner remedied this defect. He did not improve the details of Bell's transmitter, but he made a new type of transmitter, which, of course, produced Bell's electrical undulations (every speech transmitter must do that), but did it by a mode of operation utterly unlike that of Bell's magneto transmitter, and by the employment of an entirely different set of electrical principles or laws. And Berliner's type of transmitter, known as the microphone, is now almost universally used.

"A rather mild attack has been made upon the efficiency of the specific transmitters which are described in Berliner's patent. Undoubtedly the carbon transmitter is better than one with metal electrodes, as is shown by the commercial use of the former. But the latter will transmit speech, and if the carbon electrodes had not been practicable, metal electrodes would certainly be in use to-day, with the improvements made in Berliner's earliest type of instrument which experience always suggests.

"Defendants contend that the patent (No. 233,969) issued to Berliner on November 2, 1880, and based on his receiver invention, invalidates the claims in issue of his patent which are based solely on his telephone transmitter. This portion of the case at bar is free from difficulty. Berliner made two distinct inventions, each of great brilliancy. As a matter of fact, they were made at different times, his new transmitter being invented in January, 1877, and his new receiver in April, 1877. This distinction in date emphasizes the distinction between the inventions, though the inventions would still be distinct, if not clearly separable in time of origin.

"Berliner applied for his patent in suit on June 4, 1877. In this he refers to his receiver, but without fully describing its mode of operation. He expressly disclaims the receiver, as being the subject of claim in another application; and his first and second claims here in suit relate solely to his transmitter, as is admitted by all. Berliner applied for his receiver patent on September 3, 1880, this application being a division of his earlier application. In this patent he describes his receiver fully, referring to his transmitter as 'claimed by me in another application filed June 4, 1877.' Of the four claims the first three relate solely to his receiver, as all agree, while the fourth claim relates to the combination of his receiver and transmitter. Nobody has ever used Berliner's receiver commercially, and no one disputed Berliner's claim to a patent for it. Hence the receiver patent issued promptly on November 2, 1880, while issue of the transmitter patent was delayed until 1891 by interferences and other actions of the Patent Office, for which delay the Court of Appeals of this circuit and the Supreme Court of the United States have held that neither Berliner nor his assignees were in any way responsible.

"The government's attempt to punish Berliner for this delay by annulling his patent failed signally, yet the argument of 'double patenting' now presented is simply a renewed attempt by an infringer to inflict the same penalty on Berliner for the same reason, namely, that the Patent Office held back the issue of his transmitter patent.

"His application for the transmitter patent was the first to be filed, and his receiver patent expressly referred to his claiming the transmitter in that earlier application. Not only was there no abandonment of claim for the transmitter, but the public was fully warned of such claim by the receiver patent itself.

"The claims in issue relating to the transmitter patent are two only, as follows: '1. The method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact, so as to strengthen and weaken the contact, and thereby increase and diminish the resistance of the circuit, substantially as described. 2. An electric speaking-telephone transmitter operated by sound waves and consisting of a plate sensitive to said sound waves, electrodes in constant contact with each other and forming part of a circuit which includes a battery or other source of electric energy and adapted to increase and decrease the resistance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.'

"The claims relating to the receiver patent are four, as follows: '1. The herein-described method of producing sound vibrations in a plate by causing a varying electric current to pass to the plate or to an electrode connected therewith, from a second electrode in contact therewith, substantially as described. 2. An apparatus for producing sound by means of a varying electric current, which consists of a plate forming or carrying an electrode placed in contact with another electrode, from one to the other of which the electric current is caused to pass. 3. An electric telephone receiver, to be operated by varying electric currents, and consisting of two contact pieces within an electric circuit, one or both of which pieces consist of or are connected with a vibratory diaphragm, whereby one electric current passing through said circuit exercises a repulsion between said two electrodes corresponding to its strength, and thus produces corresponding motions in the diaphragm. 4. A system of two or more telephone instruments in electrical connection with each other, each consisting of two or more poles of an electrical circuit in contact one with the other, either or both poles of each instrument being connected with a vibratory plate, so that any vibration which is made at one contact is reproduced at the other, substantially as set forth.'

"Nobody contends, as we understand it, that if the receiver patent contained only its first three claims, the two patents would be for the same invention. The language of these claims is too clear to require comment. The government, by its bill and expert, only contended that claim 4 of the receiver patent covered the combination of transmitter and receiver, and drew the plainly erroneous conclusion that claim 4 therefore invalidated the transmitter patent.

"The case then narrows down to the single issue, whether the fourth claim of Berliner's receiver patent invalidates claims 1 and 2 of his transmitter patent, as being 'for the same invention.' But it would seem to be elementary that a combination claim, like the fourth claim of Berliner's receiver patent, does not cover the same invention as a claim for a single element thereof. This the courts have repeatedly held."

Counsel here cited several instances of decisions on such points.

Passing to the contention that the sustaining of the 1891 patent unjustly prolongs the patent monopoly, Counsel Fish cited the ruling of the Supreme Court, in the case of the United States v. Bell Telephone, which says: "The mere fact of delay does not, therefore, operate to deprive the inventor of his legal rights. Whatever may be the injury to the public, if the delay is caused solely through the negligence or inattention of the tribunal before which the application is pending, it is something for which the applicant is not responsible, and which does not affect his legal rights."

Mr. Fish pointed out a number of decisions bearing upon the subject of double patenting, wherein it was expressly held that a patent for a combination of devices is not the same thing as a patent for a single element of that combination. He analyzed the claim of defendants that the suit of Miller v. Eagle Manufacturing company is analogous to the one before the court, and gave quotations from decisions in opposition to that contention, made by the Court of Appeals.

Taking up the subject of foreign patents and their relation to the patent in suit, Mr. Fish argued along the lines laid down in the testimony of Professor Cross, to the effect that neither the Canadian, British, French nor Russian patents issued to Berliner relate to the subject-matter of the United States Berliner patent in suit. Not one of them sets forth a microphone, as such, as its subject-matter.

Continuing, counsel said: "The reason why Berliner did not apply for a foreign patent on his transmitter invention is obvious from his testimony in the government record. It appears that from the autumn of 1876 until the latter part of 1878 he earned only $12 per week on an average. He was in no position to take out a proper United States patent, much less to apply for foreign patents. In October, 1878, however, he sold his transmitter invention and application thereon to the American Bell Telephone company, and, as appears by Mr. Hudson's testimony, was paid a large price for it. So that when he made further inventions in 1879 and 1880 he was in a position to take out foreign patents for them. But in October, 1878, it was too late to apply for foreign patents on his transmitter, since the microphone was well known by foreign publications in Europe."

Regarding what was covered by Berliner's applications, Mr. Fish went into details quite extensively, the gist of his argument being that the patented invention in controversy was both described and claimed in the original application, before a word of that application was altered, but, moreover, that the applicant had a clear right under the statute to complete, amend and prepare his application before the Patent Office acted thereon. Apropos of Professor Brackett's testimony on this point on behalf of the National Telephone Manufacturing company, he said:

"Professor Brackett says one skilled in the art would not have found the invention in the original application. But the specially qualified officials of the United States Patent Office did find it there. Berliner, when he filed his application, as he himself testified, 'knew that he had a perfect transmitter.' He had actually invented the microphone and clearly described it in a caveat, then on file in the Patent Office. Professor Brackett's contention that Berliner had found and recognized that his single-pin instrument would not transmit speech is doubly erroneous. That instrument will transmit speech, and it is abundantly proved in the government record that such an instrument would so operate. Berliner knew that it would so operate, as is shown, not only by his testimony in the government case, but by the contemporary evidence of his caveat."

Claims introduced regarding the alleged anticipation of Berliner's invention by the inventions of Bell and Edison were also discussed at length by the speaker. "In all the telephone litigation over the Bell patent of 1876 it was never suggested or supposed by anyone," said the attorney, "that this

patent contained any disclosure of the 'microphone' down to the argument of the government suit in the Supreme Court in the year 1896. Then the suggestion made its first appearance in a brief filed, not by the counsel for the government, but by other counsel, who were allowed to file a brief on the government side. And it has been taken up by the defendants' expert in these cases. But it is obvious from Professor Bell's description that he had no notion of a transition resistance in devising his liquid transmitter. Bell's liquid transmitter was not intended to act by variation of pressure at a joint. The description of his patent was that the more deeply the conducting wire in the liquid was immersed, the less resistance did the liquid offer. In other words, he was concerned with varying the resistance of the liquid by varying the section of the liquid through which the current passed. Every practical microphone from the beginning has been constructed with solid electrodes. Of such description are the defendants' transmitters; so are the transmitters described in Berliner's patent.

"A remarkable commentary on the claim that Berliner unjustly obtained his patent for that which was in fact invented by Edison is furnished by the fact that Edison himself, who was in interference with Berliner, Bell and others, on a number of issues relating to the telephone, never pretended to be the first inventor of the microphone, and never filed any claims which interfered with the broad claims of Berliner now in issue. It remained for infringers, 20 years after these interferences, to make this contention on Edison's behalf."

Mr. Payson's Argument.

Edward F. Payson, who presented the plea on behalf of the National Telephone Manufacturing company, followed Mr. Fish. He began shortly before adjournment on Wednesday, continued through Thursday and took up part of the day on Friday. One of the leading features of his argument was the claim that even if Berliner could be held to have produced his metal transmitter, as set forth in his description with his application, earlier than Edison produced his carbon transmitter, yet, in view of the preceding state of the art and of Edison's carbon transmitter, the Berliner patent, if valid, is of limited scope, and defendants do not infringe.

"The purpose of the bill," said Mr. Payson, "is to continue complainant's monopoly of the commercial carbon transmitter. Their contention is understood to be that Berliner was the first inventor of a new method and apparatus in telephony, whereby pressure of sound waves upon the diaphragm varies the contact and pressure between electrodes in constant contact, and thereby varies accordingly the amount of current passing to the receiver. The three alleged novelties of their case are constant contact, variable pressure and transition resistance. Defendants," he added, "first briefly controvert the construction put upon the patent by complainants, and also submit the general situation arising from the controversy over Mr. Bell's patent, its monopoly of carbon, the great value of that monopoly, and the propriety, in view of the great interests at stake, of confining the complainants' use of presumption arising from the grant of a patent strictly to the subject-matter of such method of proof, and of requiring proper and sufficient evidence of the alleged breadth and scope of the invention depicted and described in the patent."

Counsel summarized the testimony of Professor Anthony of Cornell, as set forth in the government record, and said: "His testimony is that the Bell liquid transmitter varies the pressure, and that whether a transmitter have one solid-metal and one mercury electrode, or have two solid-metal electrodes, or have one or both of its electrodes of carbon, the cause of varying resistance and telephonic action is this—the variation in the intimacy and area of the contacting portions of the electrodes at the juncture of the electrodes—and that in this particular there is no difference whatever except in degree between the Bell mercury transmitter, the Berliner transmitter and the commercial carbon transmitter. In all three cases the pressure of the air waves upon the diaphragm moves the diaphragm, and the diaphragm jostles the electrodes and varies the pressure between them and the intimacy and area of their contact. But carbon possesses peculiarities of structure and action, which render it available when the mercury and the metals are not available."

From this the speaker deduced the following conclusions:

"Even if Professors Brackett and Anthony, who agree on these points, are wrong, and the actions of Bell's mercury and Berliner's metal transmitters were dissimilar, in that Bell varies the resistance by varying the length of the mercury column, but Berliner by varying the contact pressure of metals, still the scope of the Berliner patent must be limited to the real novelty over Bell, inasmuch as both the mercury and the metal transmitters are included in and merely varying forms of Bell's invention of 'varying the resistance of the external circuit,' and as both use this method, and only differ in their materials and the ways in which the different materials perform the same function, Berliner must be confined to his described metal electrodes and known equivalents therefor:

"First, by the patent law as to secondary inventions; second, by his claims when limited by his specification; third, by the proof that carbon electrodes are not the equivalent of metal electrodes except as metal electrodes are the equivalent of one mercury and one metal electrode; fourth, by the fact that, even if carbon be an equivalent of metals, that fact, and that it is so much more than an equivalent, was entirely unknown at the date of Berliner's alleged invention."

A second defense was next touched upon by Attorney Payson and stated thus: "Berliner's application of June 4, 1877, describes a single-pin instrument like the old mechanism of Regnault and of Reis, and does not describe this device, the manner of using it or its 'principle' as a variable but constant-contact speech transmitter, nor distinguish it from prior inventions; and, instead of showing how to transmit speech with it, says it is not adapted thereto. This is a question of fact.

"The most favorable statement of the application is to say that the one-pin device is described as operating by make-and-break, and, under the scraping with a knife-blade, as he describes, by weakening; that is, as operating so much of the time as a circuit-breaker as to exclude 'constant contact' and be 'unadapted to transmit special sounds;' and the two-pin device which he describes is added to enable transmitting speech. This does not support the patent as granted.

"The patent which would have issued upon this original application would have been for a peculiar circuit-breaking method of transmitting speech, a double-pin circuit-breaker as a speech transmitter, a single-pin receiver and for two instruments in combination.

"How can it be plausibly argued that an application which would have supported such a patent as this in 1877 is the proper foundation for the patent in suit, which issued in 1891? How can it be argued that, had such patent issued, it could be reissued as the patent in suit?

"Had Berliner the right in August, 1877, to erase the double-pin structure and the described inability of the single-pin device to transmit speech and insert a description of constant-varying contact in the single-pin device?

"September 8th he inserted 'carbon,' changing the drawings, from which it would appear that he had tried and found that his single-pin instrument would talk with carbon, as would Edison's (published in Telegraph Journal of July 16, 1877); that therefore a proper single-pin instrument would do the business, whereupon he erased the double-pin instrument."

Counsel traced the course of the patent through the Patent Office, the amendments proposed, the rulings made, and reached the conclusion that "the June 4th application cannot support the patent in suit; the August-October amendments cannot support the patent in suit. If they could it would be by reason of such contradictions of the original application as to render them inadmissible as amendments thereof. If the amendments were allowable, the Berliner application dates from their filing, and not earlier than August 8 or October 27, 1877. If this proposition is sound, then Edison's application of July 20, 1877, throws the burden on the plaintiff. If the amendments of August-October make the June 4th application sufficient as of that date, then Edison's application of April 27th throws the burden on complainants."

As a third defense Counsel Payson took up the history of Edison's work on the telephone, claiming that the carbon transmitter, which revolutionized telephony, was the invention of that scientist. It was argued that he had the conception first, got speech first, detected the commercial uselessness of metal electrodes first, and was the first to discover, to apply for patents on and to embody in practical working form the carbon transmitter, the only variable-resistance transmitter ever used commercially.

The fourth point raised was supplementary to the third, and was stated to be that "if Berliner had never experimented in telephony that art in June, 1877, would have been precisely the same, and that art to-day would be precisely where it is. The transmitter set forth in his patent in suit contributed nothing ever used in or useful to that art. The rights, if any, under that patent are secondary and purely technical. Defendants' transmitters contain nothing derived from Berliner, and are neither within the scope of that patent nor an infringement of it, even if it be valid. Eliminating what the unquestionable prior state of the art and the Bell inventions furnished and what the carbon transmitter of Edison furnished, nothing can be found in defendants' carbon transmitters of which Berliner was the inventor.

It was further submitted as a fifth proposition and argued on that basis, that even if Berliner made two distinct inventions, one a transmitter and the other a receiver, he exhausted all his right to a patent or claims therefor by the terms of his 1880 patent, wherein transmitter and receiver are named, alternately, to be used in these two capacities.

Briefly, in conclusion, the question of foreign patents was examined. On this point Mr. Payson said: "In the contingency of the court declining to find in Mr. Edison's inventions everything broadly which the complainants rely upon in the Berliner patent in suit, defendants urge that, if not limited by the Edison patents, the Berliner Canadian, British and French patents would in their respective countries he given all the scope that can be given to the patent in suit, and that their expiration carries with it the expiration of the patent in suit."

Mr Maynadier's Address.

J. E. Maynadier, who made the plea for the Century Telephone company, occupied the remainder of Friday with his arguments. Beginning with the inquiry: "Can the Bell company have the monopoly of the telephone for 32 years?" he proceeded to refute the proposition, first assuming for the purpose of this branch of the questions involved that Berliner discovered "a new way of varying resistance much better than any way known to Bell," and that both the Bell and Berliner patents were entitled to a reasonable monopoly of the benefits attaching thereto.

"Both these monopolies," said he, "were bought by the Bell company more than 17 years ago. Up to March, 1893, the company had the full enjoyment of both, for the reason that the greater, or Bell, monopoly of the current includes the lesser, or Berliner, monopoly of a better way of producing the current.

"The Bell company now asserts that, as a matter of strict law, it owned only the Bell monopoly up to November 17, 1891, and an inchoate right only to the Berliner monopoly up to November 17, 1891; and that, although it owned both monopolies from that date to the expiration of the first Bell patent in 1893, it has owned only the Berliner monopoly since March, 1893; and that there is nothing in these facts which makes it improper for the Bell company to enforce the Berliner monopoly up to November, 1908.

"It is simply monstrous for the Bell company to make this assertion. The Berliner 1891 patent is void for the reason that one claim, at least, is void. The bill has been amended by striking out all mention of the third and sixth claims. It is nevertheless submitted that defendant has full right to attack these claims; that each claim is void; that if either be void the patent is void, and cannot be saved by disclaimer. The Berliner patent of 1891 is void for the reason that it repatents what was already patented in the Berliner 1880 patent.

"Since the expiration of the 1880 patent on November 2, 1897, the public has had full right to use two of the Berliner instruments together as a telephone system. Here is a most interesting state of things. Here is a contract between Berliner and the public, dated in 1891, by which the public gives Berliner the right to exclude the public from the use of his transmitter discovery until 1908, and an earlier contract between Berliner and the public, dated in 1880, under which Berliner admits that the public has full right to use his transmitter discovery, with a definite qualification having nothing to do with the 1891 contract, after November 2, 1897. It follows that the 1891 contract and patent are void, for obviously the public has not given the commissioner of patents nor anyone else authority to exclude the public from the use of the system of the fourth claim of the 1880 patent one minute after November 2, 1897, much less for 11 years and 15 days after that date.

"Moreover, the 1891 patent is void, for the reason that the transmitter discovery was not described in the original application, and that invention was improperly introduced by amendment. In the opinion of the defendants' counsel this defense is ample in itself, and without aid from any other, to fully sustain a decree dismissing the bill on the ground that the 1891 patent is void."

Mr. Maynadier asked leave to file a supplemental brief, embodying arguments made by him in connection with the points raised, and more detailed than the short abstract which was put in by him prior to the presentation of this request.

Judge Taylor's Speech.

Judge R. S. Taylor of Fort Wayne, Ind., who appeared by consent for the Williams Electric company, and who had been prominent in the late government suit, appearing as one of the counsel in the appellant's case before the Supreme Court, was the speaker on Saturday, and continued through Monday forenoon.

His opening remarks were based upon the claim for the defense that Berliner's device was anticipated by Bell's liquid transmitters. "To the complainant's contention," he said, "that the variation of pressure between the electrodes in the Berliner transmitter was a variation of mere pressure without change of area of contact, while in Bell's transmitter the variation was mainly one of depth of submergence of the solid electrode in the fluid electrode, and consequently of area of contact between the two, and of the aggregate conductivity of the fluid, I rejoin that the difference, granting it to exist, as claimed, is immaterial.

"If there was, intervening between the variations of pressure and the result in Berliner's transmitter, some occult electrical or mechanical action or process, not present in the operation of Bell's transmitter, which differentiated the two, then that occult action or process is the essence and the limit of Berliner's invention, and it should be distinctly pointed out and claimed by him.

"Claims 1 and 2 must be held void because anticipated by Bell's variable-resistance transmitters, or else limited to a process and an apparatus in which solid metallic electrodes are employed. Berliner discovered that the variations of pressure between two solid metallic electrodes in contact, produced by the vibration of a telephone diaphragm, would

produce sufficient variation in the resistance in the circuit to produce the undulations of current necessary to transmit speech; and that is all he discovered. That discovery left the field open to others to discover that other forms of matter being used as electrodes and subjected to varying pressure would exhibit a like variation of conductivity, and so serve a like function in a speaking telephone.

"Berliner did not discover that an undulating current would transmit speech, nor that variations of resistance would produce an undulating current, nor that variations of pressure between electrodes would produce variations of resistance. He discovered that variation of pressure between certain substances which Bell did not think of using would produce that result."

Judge Taylor proceeded to discuss the proceedings whereby Berliner's amendment which named a carbon electrode as a feature of his invention was ruled out by the Patent Office and withdrawn by Berliner in accordance with that ruling, and said:

"The rule is familiar that an applicant who, in the prosecution of his application, strikes out a claim or a portion of his specification, in compliance with a ruling made by the office that he is not entitled to such claim or matter, is estopped after the issue of his patent to claim a construction of it which will give him the benefit of the claim or matter which he thus abandoned.

"When we consider the facts in connection with Berliner's application and the subsequent amendments they explain what would otherwise seem to be a singular course of conduct on his part. Following the 'pressure' suggestion which came to him, as he has stated, while watching a telegraph operator sending messages, he tried experiments, put his caveat of April 14th on file, turned his attention to other devices besides the single-pin transmitter, invented his double-pin transmitter and his apparatus for the production of sound by sparks. That appeared to him at the time to offer the best prospect of success. It was novel in construction, and if he could by such apparatus transmit speech by a make-and-break process, he would not only do something not done before, but he would be independent of Bell. Hence, it was that in his application as filed the only forms of apparatus shown to which he attached any value were the double-pin transmitter, the single-pin instrument as a receiver and the sparking and recording apparatus.

"The retention of the device last named in the patent as issued is a circumstances to excite curiosity—a long description of an utterly useless piece of apparatus, without any claim based upon it. Why was it kept in the specification when so many other changes were freely made? Simply because if it had been erased the metamorphosis of the application would have been too bald for concealment."

Quoting from the description of Edison's apparatus published July 9, 1877, in the Philadelphia Press, Judge Taylor continued: "This was a clear and sufficient description of the Edison carbon microphone. It was published 35 days after Berliner filed his application and before he had made any amendment of it except the amendment recorded July 27th, relating to the double-pin instrument. If the application, as filed, did not describe the microphone, an amended application describing the microphone, filed after this publication, would be prima facie anticipated by it.

"The Edison carbon microphone had been in public use more than two years before September 1, 1880, the time of the filing of the metamorphosed application. To this I may add that no claim was made in the application for any method or process until the amendment of September 1, 1880. The method covered by claim 1 had then been in public use more than two years. Why is not that claim barred by that fact alone?

"Berliner's patent of 1880 described both the transmitter and receiver as inventions of the applicant. The patent of 1880 would have been valid with its fourth, or combination, claim alone. After the grant of the patent of 1880 no new act of invention was necessary for the production or use of the transmitter; hence no new or additional patent could be issued for that device."

Mr. Betts' Argument and the Close of the Hearing.

Closing arguments for the complainants were begun on Monday by Frederick H. Betts and continued through to-day (Tuesday). Mr. Betts dwelt particularly upon the claims of opposing counsel regarding Bell's liquid transmitter and Edison's inventions, with a view to showing that Bell's device did not anticipate the principle embodied in Berliner's invention that makes it commercially valuable and constitutes the basis upon which the art of speech transmission has rested ever since, while Edison's experiments prior to Berliner's application for a patent had not solved the problem of speech transmission or led to the discovery of the principle which Berliner applied.

"The gist of Berliner's invention is found in the application of his discovery as set forth in claim 1," said counsel. "The great thing invented was a part of the method of operation, whereby variable pressure produces varying resistance. This law, utilized in apparatus devised for the purpose, made the telephone of to-day a possibility.

"This principle was not recognized by Bell as an element in his liquid transmitter, nor was he working along that line of thought in his experiments. Hence, it is radically incorrect to assume that he anticipated Berliner.

"Nor has Edison ever claimed the discovery of the underlying principle upon which telephonic action is based. Yet he has been a most prolific filer of caveats, and would undoubtedly have claimed an invention of such importance if it had been his by priority.

"The attempt to restrict Berliner to metal electrodes on the ground that Edison first utilized carbon and because the Patent Office ruled out the allusion to carbon in Berliner's revised application may be answered by stating what is a fact, that carbon was not a new or novel agent in electrical experiment at the time, for it had been used in electric-lighting experiments and inventions, and in various other ways. It was one of the most natural things in the world for Berliner or Edison or any other experimenter to use. This erasure from Berliner's application does not affect the fact that the underlying principle of operation is unaffected by any question arising over the material of which electrodes are made."

Taking up in order the various other claims of the defense, Mr. Betts made a comprehensive plea for the Berliner invention. In closing he said: "It has been stated in the course of the arguments on the other side that 75,000,000 people are the defendants in this case, which makes it the most stupendous on record. Even if this be true, I know of no presumption of law or fact arising therefrom which should sway this court either way in the matter. I suppose that the true interests of the 75,000,000 people of the United States will be best conserved by the administration of exact justice, regardless of who are defendants or complainants in the case."

Leave to file a supplementary brief, summarizing his oral argument, was granted to Mr. Maynadier, and leave to submit his oral argument in print from stenographic notes was granted to Judge Taylor.

Complainant's counsel will also have an opportunity, by consent, to reply to additional or amended points that are raised in these papers. Two weeks are allowed by Judge Brown for these to be prepared and submitted, and decision will be reserved.

J. S. B.

MANUFACTURERS AND DEALERS.

Attica, Ind., is to have a new telephone-exchange plant, the apparatus selected being of the Sterling Electric company's make. Three hundred numbers of switchboard, a distributing board and combined terminals and protectors are the initial order. The Sterling Electric company also reports contract with the Century Construction company of Cleveland, O., for 400-number equipment, including switchboard, distributing board and combined terminals and protectors.

James S. Cuming, president of the Central Telephone and Electric company of St. Louis, reports a constantly increasing demand for the products handled by his company. As is well known, this concern carries a complete stock of everything used with telephones and the company modestly states that no order is too small for its attention or too large for its capacity. It makes a specialty of filling each order with promptness and with the greatest care, and consequently its patrons are more than pleased with the service rendered. The company has lately placed on the market a number of new telephone specialties, which are described in its new catalogue, which will be sent to persons interested on request.

The Stromberg-Carlson company asserts that its "central-energy" system is the most convenient and economical system now in use for small as well as large telephone exchanges. It refers to the "central-energy" system recently installed at Noblesville, Ind., by the New Long-distance Telephone company of Indianapolis, Ind., which has met with such success, it is said, that the business of the exchange is increasing rapidly. The original Independent exchange had about 125 subscribers when sold to the Bell company, and the New Long-distance company did not provide for more than 200 lines when starting, believing that the exchange would not reach that number, but it was recently obliged to order an additional section of switchboard and telephones, and at the present rate of increase the exchange will soon reach the 300 mark.

The Western Electrical Supply company, St. Louis, reports that its telephone department is crowded with orders. It has been pushing this department of its business, and being general electrical supply dealers, as well as manufacturers, the company claims to have an advantage over the strictly telephone manufacturers. The company is prepared to equip a line and exchange with complete construction material, telephones and switchboard from stock, and is therefore able to guarantee prompt and satisfactory deliveries. It has recently closed a deal with the Victor Telephone Manufacturing company, whereby it will handle a large share of the output of the Victor factory, having taken the exclusive agency for this company in the South and west of the Mississippi River, covering 27 states. Having one of the best telephone engineers in the country at the head of this department, the company is not only prepared to answer but wishes to encourage inquiries concerning installation or operation of telephone exchanges and lines.

Telephone, Telegraph and Cable Company of America.

A Trenton, N. J., dispatch, dated November 9th, states that articles of incorporation were filed with the secretary of the state of New Jersey on that day of the Telephone, Telegraph and Cable company of America, with an authorized capital of $30,000,000. This company is empowered to do a general telephone and telegraph business. The corporators are William J. Latta and Martin Maloney of Philadelphia and James E. Hayes of Camden, N. J. The articles were filed by Mr. Hayes himself, who is said to be an attorney for the Whitney-Widener-Elkins syndicate, and it is understood that this syndicate is behind the new company, which is organized to supersede the Continental company, whose plans were referred to in the Western Electrician last week, and has for its purpose the establishment of a telephone system throughout the country in opposition to the Bell Telephone company.

The stockholders of the Telephone, Telegraph and Cable company of America met on November 13th and elected the following-named officers: President, William J. Latta; secretary, George F. Hawkins; directors, William J. Latta, Martin Maloney and James E. Hayes. The articles of incorporation show that Latta, Maloney and Hayes have but 10 shares each. The shares are of $50 each.

It is said to be the intention of the new company to establish long-distance connections between Boston, New York, Washington and Pittsburg, and to establish local connections at intervening points and eventually to branch still further out.

William J. Latta, president of the Continental Telegraph, Telephone and Cable company, said to a reporter that the Telephone, Telegraph and Cable company of America would be a consolidation of telephone companies throughout the country which are independent of the Bell Telephone company. Mr. Latta added, as quoted: "We do not hold options, but whatever companies we need we control. The Independent companies number in all between 2,000 and 3,000. We are going to build long-distance telephone lines, and the formation of any antagonistic companies in Chicago does not concern us."

George W. Beers, who is also interested in the new company, is thus reported: "We have all we need to make the company a success. It is going in to furnish long-distance service throughout the country."

The negotiations for the consolidation of the People's Telephone Corporation and the Knickerbocker Telephone company, the two companies in New York city not controlled by Bell Telephone company interests, are still proceeding, and it is expected that an agreement will be reached within the next few days. The Knickerbocker company is understood to be closely related to the Continental Telegraph, Telephone and Cable company.

United Telephone and Telegraph Company.

The United Telephone and Telegraph company was incorporated on November 8th at Trenton, N. J., with $5,000,000 capital stock, by Alexander Brown, Henry A. Parr, Thomas J. Hayward, S. Davies Warfield and James Bond, all prominent Baltimoreans. Pittsburg and Baltimore telephone plants will be absorbed by this company at once, says the Baltimore World. George R. Webb, president of the Maryland Telephone and Telegraph company, who has been the moving spirit in both the Baltimore and the Pittsburg companies, was instrumental in bringing about the consolidation and formation of the new company. Mr. Webb is also interested in the Maryland Telephone Manufacturing company, which will manufacture the various patents controlled by the United company. All the lines owned and controlled by the United are to be connected by long-distance service. The Pittsburg plant may be in operation by March 1st. The company is already giving service in Baltimore; the new exchange and pole lines will be completed by April 1st; the Baltimore company's plant is to equip 7,500 telephones and the Pittsburg plant 9,000. The United company is said to be entirely distinct from the Continental Telegraph, Telephone and Cable company and its successor, the Telephone, Telegraph and Cable company of America, the Independent companies which have attracted so much attention of late.

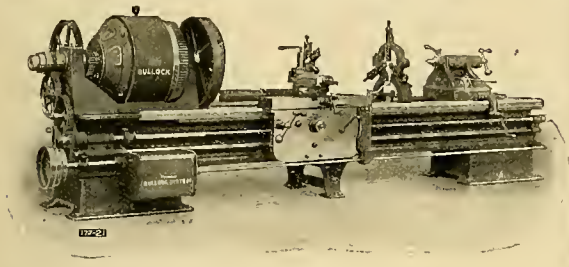
Cook Telephone-protector Litigation.

Owing to the serious illness of C. C. Bulkley, attorney for the complainant, the final hearing in the Court of Appeals at Washington of the suit of Frank B. Cook against the Western Electric company for infringement of patent on telephone and switchboard protectors has been postponed from the November to the January term.

It is stated that Mr. Cook, who is now president of the Sterling Electric company, expects to turn his attention to other alleged violators of his patent rights as soon as the decision in the above case has been rendered, and which he has reason to expect will be in his favor, as his claims have been upheld three times in the lower courts.

Motor-driven Engine Lathe.

An interesting application of an electric motor in machine-shop practice is shown in the accompanying illustration, which represents a 28-inch swing screw-cutting engine lathe driven by a Bullock type N motor. The motor is placed directly on the spindle in the head-stock, taking the place of the cone pulleys. The armature spider is built directly upon the hollow spindle of the lathe. By means of a new system of variable-speed control, the motor is given a greater range of speed, without loss of torque, than is ordinarily given by the cone pulley, having 16 speeds in either direction, including the back gear. The controller is placed upon the leg of the lathe, directly under the head-stock, and is operated by a splined shaft running along



MOTOR-DRIVEN ENGINE LATHE.

the bed of the lathe and a handle which travels with the carriage. The slowest speed is 60 and the highest about 250 revolutions a minute. The motor is fully described in Bulletin No. 2235, which may he had by addressing the Bullock Electric Manufacturing company, Cincinnati, O.

Rhode Island Electrical Works.

The electrical trade in general has already been apprised of the fact that P. C. Ackerman, who was long the New York manager for one of the well-known wire manufacturers of this country, and who has had an experience of nearly 20 years in the bare and insulated-wire business, has been appointed general sales agent for the Rhode Island Electrical Works of Pawtucket, R. I. For the information of those not familiar with this concern, it should be stated that the Rhode Island Electrical Works has been organized for some months, and although the preparations were quietly made, the company is now in possession of a fine factory in Pawtucket, R. I., already in operation and turning out magnet wire. It is the purpose of the Rhode Island Electrical Works to devote itself exclusively, for the present, at least, to the manufacture of magnet wire. It is further the intention of this organization, to quote the words of General Sales Agent Ackerman, "to extend its present plant and factory until it is as large, if not larger than any magnet-wire works in the United States."

The Rhode Island Electrical Works is officered as follows: President, Eastwood Eastwood; treasurer, Charles D. Wood; general manager, A. F. Montgomery; general sales agent, P. C. Ackerman. The works are at 232 Front street, Pawtucket, R. I., with the main sales office in New York at No. 26 Cortlandt street, where must be addressed all communications relative to the sale or other disposition of the company's product.

A. F. Montgomery, who is general manager of the Rhode Island Electrical Works, and from under whose hands the product of the company will issue, is the designer of a great deal of the machinery used in the works. Mr. Montgomery is a man of a large and thorough experience in the production of magnet-wire-winding machinery, and with him in charge the company feels, of course, confident that the product will be all that the most fastidious user of magnet wire could demand.

Space Telegraphy on Pacific Coast.

Through the efforts of the San Francisco Call the news of recent arrivals of returning troopships from Manila has been transmitted by space telegraphy from a lightship eight miles at sea to the Cliff House on the shore and thence by ordinary means to the newspaper office. This was done without the use of a vacuum coherer by the employment of apparatus designed by H. J. Wolters, chief engineer of the Claus Spreckels building, with the assistance of Frank O. Broili of the California Electrical Works. Zinc cones were placed at the top of the vertical wires at sending and receiving stations, and very successful results were attained.

Institute Meeting in Chicago.

A meeting of the western branch of the American Institute of Electrical Engineers will be held at the Technical Club, Chicago, on the evening of November 22d. Mr. A. V. Abbott will give a demonstration of space telegraphy. Arrangements have been made so that Institute members and their friends may dine at the club on that evening. Mr. R. H. Pierce of 1409 Manhattan building, local honorary secretary of the Institute, is in charge of the affair.

An Adjustable Electrolier.

The attention of the electrical trade is directed to the illustration showing an automatic adjustable electrolier for the placing of incandescent electric lights at various heights, which the Electrolier company, 27 Daniels avenue, Pittsfield, Mass., has secured the exclusive right to manufacture and sell.

This device is of the spring-balance type, and is in every way a serviceable and practical fixture for its purpose. It is composed of a porcelain base upon which is mounted two standards supporting a drum upon which the cord is wound, the cord

AN ADJUSTABLE ELECTROLIER.

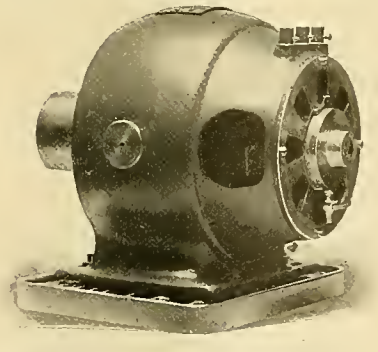
being electrically connected to each pole of the drum. Each standard is connected by a fuse to the main contact pieces, thereby taking the place of the fuse rosette in common use. Two hooks are provided to make contact with line wires for outside or track wiring. There are also two holes in the porcelain base to bring through wires for concealed wiring; the whole is enclosed in a brass shell (built in four different finishes, silver-striped, bronze-striped, brass-striped and polished brass), making an attractive and convenient fixture.

It is necessary only to take hold of cord and raise or lower, as is desired; the action is the same as in operating the common spring-balance curtain. There are no unsightly loops of cord or balls to swing light after being adjusted.

Each electrolier is tested before leaving factory by a careful and interested inspector and is guaranteed to work satisfactorily.

Clark Semi-enclosed Motor

The small semi-enclosed motor which is the subject of illustration is especially designed for direct connection to machine tools and other light machinery, and is made in sizes of from one-half to five horse power. Simplicity of construction is one of its notable features, and in actual operation the motor requires little or no attention. The bearings have large wearing surfaces and are self-lubricating. Steel field-magnet coils and pole-pieces and form-wound armature and field coils are employed. James Clark, Jr., & Co. of Louisville, Ky., the well-known manufacturers of electrically driven tools, are makers of this and several other



CLARK SEMI-ENCLOSED MOTOR.

types of dynamos and motors. They announce that they will soon remove into a new and large factory, which will double their present capacity and will be strictly up-to-date as a manufacturing plant, as all machines will be independently driven by electricity.

Pollak and Virag in Chicago.

Anton Pollak and Josef Virag, the Hungarian inventors of the rapid-transmission telegraph system which is soon to be tested in Chicago, arrived in this city Tuesday evening, November 14th. They came direct from Hungary and arrived in New York city on November 11th. Accompanying the inventors is Adolf Heermann, Jr., the Hamburg representative of the Guardian Trust company of Chicago, under whose supervision and for whose interests the telegraph system will be tested.

As yet no definite arrangements for the tests have been made, but it is expected that wires between Chicago and New York and also San Francisco will be used. It is possible that messages will be sent roundabout to a distant place and back to Chicago, so that they can be sent from and received in the same room.

CORRESPONDENCE.

New York Notes.

New York, November 11.—Guglielmo Marconi, who sailed for England on the St. Paul Wednesday, stated before leaving that he had sold the rights to his wireless-telegraphy system in America, but would not give the name of the company which had bought them. Mr. Marconi took with him a full set of his instruments. He expected to be able to communicate with the English government station at Land's End when the St. Paul gets within 100 miles of that point, and thus give the passengers the latest South African war news some time before the boat touches shore.

In changing its motive power from steam to electricity and in making the improvements necessitated by the change, the Manhattan Elevated Railroad company has practically decided to divide the contracts for the work between the General Electric company and the Westinghouse Electric and Manufacturing company. The contracts will be for the equipment of a power house at Seventy-fourth street and East River, and for sub-stations along the lines of the Third and Sixth avenue elevated roads. It is expected that about $8,000,000 will be expended in making the improvements contemplated. At the present time about one-third of the excavation has been made for the main power house.

The amount of the bond to be required from the contractors for the construction of the underground roads was reduced by the Appellate Division of the Supreme Court yesterday from $14,000,000 to $5,000,000. By this action the Rapid Transit Commission claims that a serious obstacle to the construction of the underground railway has been removed. The bond now required by the court in conjunction with the security exacted by the statute is believed to be ample to protect the city. The commission will now proceed to advertise for bids, with renewed hope that the near future will see the actual beginning of construction.

A public hearing to all persons interested in the proposition to bar automobiles out of Central Park was given Thursday by the park commissioners and about 30 persons appeared. They were evenly divided as far as sentiment for and against the automobile went, and while no decision was announced, the hearing is believed to have had an educational effect which will ultimately lead to the granting of automobile rights equal to those of horse owners.

The Jersey City, Hoboken and Paterson Street Railway company, a branch of the Shanley trolley system, which includes a majority of the street-railway lines in northern New Jersey, was organized last week in Hoboken. The companies united are the North Hudson County Railway company, the Paterson Street Railway company, the Paterson Central Electric Railway company, the Saddle River Traction company, the Palisades Railroad company, the White Line Traction company, the Paterson, Passaic and Rutherford Electric Railway company, the Jersey City, Hoboken and Rutherford Electric Railway company and the Paterson Horse Railroad company. The capital stock of the new company is $20,000,000 and the officers elected are: President, David Young of Newark; vice-president, John F. Shanley of Newark; treasurer, George W. Roe of Newark; secretary, William C. Doubleday of Jersey City; directors, William C. Shanley of Newark, William J. Davis of Harrison, General Bird W. Spencer of Passaic, Peter Hauck, Jr., of Newark, Edward L. Young of Jersey City, Philip Hexamer of Hoboken, James J. Corbiere of Caldwell, Halsey M. Barrett of Bloomfield, David Young, John W. Omberson of Newark, Frank M. Stillman of Rahway, George R. Waite of Jersey City, John F. Shanley and Warren S. Hall of Hoboken. President David Young, who is general manager of the North Jersey Street Railway company, the main corporation of the syndicate, will also be general manager of the new company.

A novel addition is soon to be made to the equipment of the New York Fire Department in the shape of a complete electric-searchlight outfit on wheels. The machine will resemble a fire engine in general appearance, and will use a similar boiler, but, in place of the pumping machinery, the engine will drive a dynamo which will supply current for the searchlights. There will be two searchlights, each with an 18-inch projecting lens, and these will be carried on a platform behind a driver's seat. They can be used either from the platform or removed and carried to any convenient place near-by, their connection with the dynamo being kept up by means of flexible cables. The purpose of the new apparatus will be to light up dark parts of the street and aid firemen in laying hose, setting ladders, etc., and also to light up the fronts of the building where people may be in danger.

The directors of the American Steel and Wire company met yesterday at the company's offices in this city. The officers of the company at the conclusion of the meeting refused to give out any information as to what business was transacted. It was reported on Wall street during the day that the Waukegan plant of the company, recently burned, will be rebuilt and enlarged at a cost of $1,500,000.

M. L. G.

PERSONAL.

W. J. Watson has been appointed New York manager of the American Electrical Works, succeeding P. C. Ackerman.

H. I. Johnson of the Manhattan Electrical Supply company, New York city, recently returned from a combined business and pleasure trip through the northern part of New York state.

Mr. G. Marconi sailed from New York for England on Wednesday, November 8th. He was obliged to defer his projected address before the American Institute of Electrical Engineers.

Dr. I. A. Lumpkin of Mattoon, president of the Illinois Telephone association, was in Chicago last week. He reports that the outlook in the Independent telephone field in this state was never more promising.

Mr. A. C. Shaw, well known in the electrical newspaper field, sailed on November 4th for England, where he will make his residence hereafter. The evening before his departure a number of his New York friends tendered him a dinner and presented a cane to him.

W. W. Burnham, former manager of the Electric Gas Lighting company of Boston and for 15 years connected with that concern, is now associated with the firm of Stanley & Patterson, New York city, dealers in electrical supplies. In his new position Mr. Burnham will have charge of the correspondence of Stanley & Patterson.

H. M. Whitmer, president of the Citizens' Mutual Telephone company of Decatur, Ill., died on November 3d. Mr. Whitmer, who was in his 67th year, was an old resident of Decatur and a prominent business man. He worked with great zeal and energy to make his telephone company prosperous and he succeeded in the undertaking.

Professor Henry A. Rowland of Johns Hopkins University, who was recently elected president of the newly organized American Physical society, has received a letter from Italy announcing his election as foreign member for America of the Royal Society of Lombardy, a scientific society in Italy, which corresponds, it is said, to the royal societies of Europe.

Professor S. W. Stratton, of the class of 1884 of the University of Illinois, recently assistant professor of physics in the University of Chicago, has been appointed director of the United States Bureau of Weights and Measures. Professor Stratton took the course of mechanical engineering at the University of Illinois, and afterward became instructor in physics, having in the meantime full charge of the electrical-engineering department at the time of its establishment.

ELECTRIC LIGHTING.

It is expected that light will be furnished from the Robert A. Waller municipal lighting station in Chicago after November 25th. The first circuit which will be turned on will furnish current for 154 2,000 candle power lamps. The ultimate capacity of the station is 2,000 lights, and when fully equipped it will furnish lights to a large section of the city south of Thirty-ninth street.

AUTOMOBILES.

A certificate of incorporation has been filed in Dover, Del., by the Anglo-American Rapid Vehicle company of New York, with a capital stock of $75,000,000, all of which is common stock. It is reported that the purpose of the company is to combine English and American automobile companies.

There are now, according to the Annuaire Generale de l'Automobile more than 7,000 owners of automobiles in Europe, the number of the vehicles being, perhaps, 10,000, nearly two-thirds of these being owned in France. There are more than 600 manufacturers in France, not including the makers of parts, about 1,000 dealers, in automobiles and 1,100 repair shops. The same authority gives the number of owners of automobiles in Germany as 268, 90 in Austro-Hungary, the same in Belgium, 44 in Spain, 304 in Great Britain, 111 in Italy, 68 in Holland, 114 in Switzerland.

An automobile company is said to be forming in Rochester, N. Y., with a capital stock of $5,000,000, which will be called the Buffalo-Rochester Electric Power and Auto company. It will have its head offices in Rochester and factory in Buffalo. It is not proposed to manufacture automobiles on a large scale, the real object of the organization, according to a Rochester dispatch, being to get possession of all the valuable patents along this line possible, develop the claims to public recognition and then sell them to others. G. Alexander Hamilton of Rochester is to be vice-president and general manager of the new company.

In his annual report, recently made public, Second Assistant Postmaster-general Shallenberg recommended that bids be invited for furnishing automobiles for carrying mail between the postoffice in Chicago and two postal stations in the business center of the city, and also for the same service in screen wagons. If results favorable to the automobile are gained from this test it is probable, says the report, that automobiles eventually will supersede screen-wagon service in many large cities, and also take the place of electric cars for carrying mails where automobiles are permitted to run as fast as the cars.

Still another automobile trust is said to be in the process of formation. This company is to be capitalized at $200,000,000 and is intended to combine all of the rubber, bicycle and automobile companies into one great concern. Messrs. Studebaker and Riker are believed to be interested in the enterprise.

PUBLICATIONS.

A neat blotter is being distributed to the trade by the Columbia Incandescent Lamp company of St. Louis. The "Two Winners," the Columbia lamp and the yacht by the same name, are pictured on the blotter.

The Western Electrical Supply company of St. Louis is sending the trade a revised discount sheet to its general catalogue, and also a catalogue devoted to its electric novelties, which includes flash lights, searchlights, gas lighters, surgical, dental and bicycle lamps, electric scarf pins, etc.

The State University Bulletin is being issued fortnightly by the University of Illinois, for the purpose of furnishing the public with authoritative information as to the progress of the university. Under the subject-head of Engineering Notes are noted some of the subjects for theses of the present senior electrical-engineering class.

The Colliery Engineer company of Scranton, Pa., proprietor of the International Correspondence Schools has combined the three publications—the Mechanic Arts Magazine, the Steam-Electric Magazine and the Building Trades Magazine—in a single publication, under the title of Science and Industry. The new magazine will be a 64-page monthly.

Some months ago the B. F. Sturtevant company of Boston, in a neat little pamphlet entitled "Draft Without a Chimney," presented its experience with mechanical draft and pointed out its salient advantages. The demand for information has necessitated the publication of a third edition, which has just been issued, and may be had upon application.

The new type Sunbeam incandescent lamps are handsomely illustrated in a catalogue just issued by the Western Electric company. These lamps are made regularly in three standard efficiencies, viz., 3.1 watts, 3.5 watts and four watts per candle, and are furnished in all standard candle powers. Illustrations of 110, 52 and 220-volt lamps are given, as well as of a street-railway lamp and tubular and decorated lamps.

The 1899 edition of the "Columbia Engineer," published annually by the Engineering Society of Columbia University, has recently been issued. It contains the transactions of the society for the year 1898-99 and also eight lectures that were given before the members during the last college year. One of these was that delivered by Thomas C. Martin on "Electrical Power Transmission and Distribution." The volume is neatly bound in cloth.

The important report of the committee of the American Institute of Electrical Engineers on the standardization of electric generators, motors and transformers, accepted by the Institute on June 26th last and printed in full in the Western Electrician of July 8th, has been issued in pamphlet form and copyrighted by the Institute. It is said that several large concerns have already adopted the standards so carefully worked out by the committee.

Several bulletins have been recently issued by the Emerson Electric Manufacturing company of St. Louis, treating of that company's motors and specialties. An automatic-illumination cylinder or revolving automatic switch for electric signs and decorations is one of the products of the firm that is described. This switch is made with any number of circuits or combination of effects. Induction sewing-machine motors, alternating-current, single-phase power motors and electric fans are also quite fully described and illustrated.

A handsome catalogue is issued by the Chicago House Wrecking company. Public attention was first attracted to this company several years ago, when it bought and wrecked much of the World's Fair material. Later it executed a similar task with the old Postoffice building. More recently the company purchased the Omaha Exposition entire, and it is now said to be figuring on buying the buildings at the Paris Exposition. In the recent Omaha purchase, as shown by the catalogue, the list of electrical goods represented would stock a supply house quite completely. The wire and other electrical supplies are for sale at what are said to be low figures. The company's catalogue of this stock will be forwarded upon request.

An attractive catalogue devoted to different forms of the Universal incandescent lamp holder and other electric fixtures has been issued by the Faries Manufacturing company of Decatur, Ill. This firm is making a strong point of its cheaper forms of adjustable fixtures for machine shops and factories. A number of factories are now being worked day and night and there is a demand for the right kind of a holder for placing the electric lamp where it will put the light where it is wanted. It is claimed by the Faries company that its adjustable holder is a fixture well adapted for factory use. The company reports having quite a large sale of its adjustable holders and portable floor stands for dentists and surgeons, such as are illustrated in the catalogue. A combined shade and holder is made which is especially adapted for the firm's own fixtures, although it may be used on any socket.

Under the title of Indice del Comercio Americano the National Association of Manufacturers has published a Spanish edition of the book which appeared under the name of American Trade Index in January last. The present issue is a book of 425 pages and follows exactly the plan and arrangement of the English volume. This book is a classified and descriptive directory of the membership of the National Association of Manufacturers, the purpose being to place in the hands of the foreign merchants a convenient handbook which shall enable them to select reputable manufacturers in the United States in any lines in which they may be interested. An edition of 5,000 copies has been issued and is being gratuitously distributed among merchants in the Spanish-speaking countries.

Two catalogues recently issued by the Westinghouse interests contain information that will attract electric street-railway men. One, published by the Westinghouse Air Brake company, is devoted to the Westinghouse electro-pneumatic system for controlling railway and other motors. This system involves the use of compressed air for moving the controlling apparatus, the admission of the air to the several parts being effected electrically by means of magnets attached to the air valves. The apparatus is very fully described and a number of especially fine illustrations add considerable value to the book. The other catalogue is issued by the Westinghouse Electric and Manufacturing company and treats of Westinghouse railway motors. A few illustrations of typical Westinghouse railway power stations form a very attractive feature of the publication. Both catalogues are very carefully prepared and the illustrations are exceptionally clear and instructive.

POWER TRANSMISSION.

Electricity generated by the Snoqualmie Falls was first brought into Seattle and put to commercial use October 26th, when the Centennial Mills and the Butler Hotel were supplied. Many other manufacturing and electric plants in Seattle are making preparations to utilize the power, and in a few days the cars of the Grant street line and the Rainier Beach line will be run by it, and eventually all roads involved in the street-car consolidation, it is said, will be supplied with Snoqualmie power.

MISCELLANEOUS.

At a meeting of the executive committee of the National Association of Municipal Electricians held in Newark, N. J., on November 2d, it was decided that the date of next year's convention in Pittsburg should be September 20th, 21st and 22d.

Experiments with compressed-air cars continue on the North Side line of the Chicago Union Traction company. General Manager Roach says that if the compressed-air system is successful during the winter, it is likely that all the "owl" cars will be operated by pneumatic motors. Two "air" cars are now running from midnight until 5 a. m. on the North Clark street line. The greatest objection to the use of compressed air in street-railway service is the necessity of frequent stops to replenish the supply of power.

TRADE NEWS.

The Milwaukee office of the Martin J. Insull company, the western selling agent of the General Incandescent Arc Light company, has been moved from the Pabst building to 408 Uihlein building.

R. Schefbauer, chief electrician of the Sterling Arc Lamp company of New York, was in Chicago this week, en route to New York. Mr. Schefbauer was recently in Centralia, Ill., where he installed 75 Sterling alternating arc lamps. Mr. Schefbauer also called on some of the other large users of Sterling arc lamps in the West and was gratified to find that the Sterling lamp was giving entire satisfaction.

U. R. Freisenburg, engineer in charge of the Polo (Ill.) electric-light plant, says that he has a boiler-cleaning compound which will remove scale from any kind of water in any kind of steam boiler. He has the care of a 150 horse power return-flue boiler, and he says that he can clean it thoroughly at an expense of 20 cents. The compound is said to be harmless to the boiler. Mr. Freisenburg has applied for a patent on it.

"You furnish the plant; we make it pay," is the announcement of the Hays Construction company, electrical and mechanical engineer, Troy, O. This company makes a specialty of remodeling old and unprofitable electric-lighting and railway plants and has a special plan to offer to those so encumbered. W. S. Hays, the manager of the company, is an engineer of repute and has been successful in the work in which he is now engaged.

Louis H. Aymé, the United States consul at Guadeloupe, in the West Indies, says that he has

been asked to procure information in relation to boilers, engines, pumps, etc., for the largest machine shop in that city. Illustrated catalogues in French, giving weights, dimensions and prices, are desired. American machinery is admired in the French West Indian colonies for efficiency and durability, although not so beautiful as the French. However, the customs tariff is very high.

An instructive illustration of the results attending the use of mechanical draft is presented in the experience of the Utica Portland Cement company of Utica, Ill. The change was recently made from a chimney to a Sturtevant fan as a means of draft production. The company says: "We formerly used five boilers and had trouble to keep up steam with a good grade of coal. We now use four boilers, and coal costing us 35 cents per ton less, and have no trouble in keeping a good head of steam."

The Marshall condensers, manufactured by William Marshall of 709 Lexington avenue, New York city, are recognized by the trade as one of the standards for high quality. They are said to have given entire satisfaction, owing to the care exercised in their manufacture and the high grade of materials which are used. Mr. Marshall has made many radical changes and improvements in the manufacture of this important product. The condenser is essentially a high-tension apparatus, and it is a difficult task to produce such an article that is highly reliable. Besides, the "personal equation" of any condenser is one that requires the closest study, and Mr. Marshall's long personal acquaintance, so to speak, with the vagaries of the condenser and its peculiarities eminently fits him to produce a condenser that is not only accurately built, but is at the same time free from that prevailing condenser disease, the "breakdown."

BUSINESS

The Electric Appliance company, Chicago, is enthusiastic over the Gutmann recording wattmeter for alternating-current work.

The H. E. Plass Electric company, 23 Barclay street, New York city, announces that it has a brand-new line of electrical novelties, many of which make excellent Christmas gifts. The company will be pleased to furnish further information on request.

The Torrey Cedar company of Clintonville, Wis., is said to be receiving its full share of the cedar-pole business. The company has furnished thousands of these poles to telephone, electric-light and street-railway companies, not only in its home territory, but in other portions of the United States, where its reputation for promptness and reliability has become known.

After a careful investigation of the various oil-feeding systems now on the market, the United Railways company of St. Louis, Mo., has decided to equip all the machinery in its large new power station with the Siegrist automatic-oiling system. In closing the contract for this work the Siegrist Lubricator company of St. Louis has successfully demonstrated the value of its system and has added another important power plant to its already large list of patrons.

Goldsmith Bros., the well-known refiners and assayers of Chicago, announce that they are in the market for scrap platinum, for which they pay $15.50 a Troy ounce. The firm is one of the best known in its line, and bears an enviable reputation, having been established since 1867. It also pays a high price for old incandescent lamp bases, and those who wish to realize on scrap platinum and burned-out lamps may find it to their advantage to communicate with Goldsmith Bros.

The Hobart Electric Manufacturing company of Troy, O., continues to meet with success in its dynamo and motor business. The company makes a specialty of manufacturing bipolar and multipolar motors, from one-half to 50 horse power, and dynamos from 10 lights to 700. A novel feature of the company's business is the renting of dynamos or motors to those who may need machines for a short time only. It is stated that the Hobart company makes special inducements to agents who sell its apparatus. Through the earnest efforts of Manager C. C. Hobart the company has built up a good business, which is well merited by the apparatus placed on the market.

Schiff, Jordan & Co. of Vienna, the manufacturers of the well-known "Ship" carbons, report that they have recently taken so many large orders in this country that it has been found necessary to send to the United States their general manager, Dr. Otto Thorsch, to make such arrangements with the New York office as will place them in a position to meet the increased demand without interfering with their European trade. The works of Schiff, Jordan & Co. at Vienna are said to be among the largest and most complete industrial establishments in Austria. In the United States the firm's carbons are used by leading central stations and many others.

ILLUSTRATED ELECTRICAL PATENT RECORD.

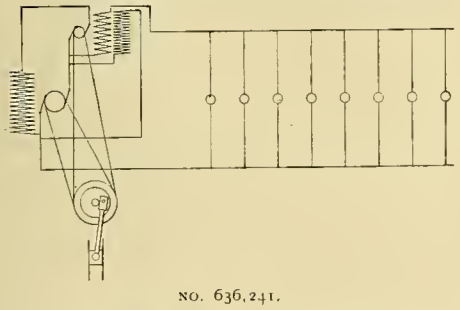
Issued November 7, 1899.

636,234. Process of and Apparatus for Electrolytic Decomposition of Saline Solutions. Elbridge Baker, Winchester, Mass., assignor to the Nashoba company, Portland, Me. Application filed May 17, 1897.

The process consists in flowing a film of mercury continuously from a higher to a lower level beneath a column of the saline solution and passing a current of electricity through the solution.

636,241. Method of and Means for Controlling Systems of Distribution. Charles A. Brown, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed March 22, 1897.

A method of controlling the current-generative power of a dynamo-electric machine is described which consists in supplying the field circuit of the machine with electrical energy derived from the main circuit thereof, interposing in the derived field circuit an armature exerting a variable electromotive force adapted to alter the flow of current through the field circuit and effecting the alteration of the value of the current by means of the resultant magnetic influence of currents flowing in series and in parallel with the controlled circuit of the dynamo-electric machine. (See cut.)



NO. 636,241.

636,244. Portable Igniter Plant. Adelbert W. Crosby, Geneseo, Kan. Application filed May 20, 1899.

The invention consists essentially of a casing containing a source of electricity and a gas supply and a tubular standard with a flexible connection at its upper end. At the end of this connection is provided a pivoted burner and electric terminals adapted to engage with each other when the burner is moved upon its pivot.

636,270. Vacuum Arc Lamp. John H. Loos, Orange, N. J. Application filed December 15, 1898.

In the lamp are combined an exhausted globe wholly containing electric-light carbons, an armature block movable within the globe and operating to move one of the carbons, an electromagnet in circuit with the carbons for attracting the armature, a screw socket secured in the bottom of the globe, a screw holder for the lower carbon fitted adjustably in the socket, and magnetically operated means for rotating the holder within the socket to adjust the lower carbon.

636,275. Signal for Telephone Trunk Lines. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed September 25, 1896.

Combined with a telephone trunk line extending from one switchboard to another and terminating in suitable terminal connection at one of the boards and in a spring-jack at the other board are a signaling circuit for the trunk line, including an indicator at one switchboard and terminating in a contact piece associated with the spring-jack at the other board, a pair of plugs and their cord circuit at the latter board, a conductor connected with a contact piece on one of the plugs and adapted to form an extension of the signaling circuit when the plug is inserted in the spring-jack, and a switch adapted to be actuated upon manipulation of the other plug in connecting and disconnecting lines, whereby the electrical condition of the signaling circuit may be changed and a signal displayed at the indicator.

636,276. Signal for Telephone Trunk Lines. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed September 25, 1896.

One claim reads: The combination with a telephone trunk line, of a signaling circuit therefor, including an indicator at one end and terminating in a contact piece at the other end, a pair of connecting plugs and their spring-jacks for extending the trunk line to make connections with other telephone lines, a conductor forming an extension of the signaling circuit and adapted to be connected therewith by the connection of one of the plugs of the pair with the trunk line, and electrical means connected with the conductor and controlled by registering contacts of the other of the plugs and its spring-jack for influencing the signaling circuit and the indicator included therein.

636,277. Apparatus for Inter-office Trunk Lines. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed September 25, 1896.

Two telephone lines and a trunk line uniting them are combined with a clearing-out annunciator at one terminal of the trunk line and an operator's calling key at the other terminal, electrical circuit connections adapted to render the clearing-out annunciator inoperative, and a switch connected with the calling key controlling the circuit connections, whereby the operation of the calling key renders the clearing-out annunciator irresponsive.

636,286. Automatic Electric Switch. Edwin F. Porter, Boston, Mass., assignor to the Bay State Electric Heat and Light company, Jersey City, N. J. Application filed December 27, 1897.

The switch is connected with a main electric circuit and independent branch circuits from the main circuit. Electromagnets and a thermostatic closer and breaker are provided, by means of which the switch is adapted to open the main circuit at one temperature and to close it at another, and a lever operated by the thermostat is adapted to alternately close the branch circuits through the magnets.

636,299. Trolley. Emmett G. Solomon, Omaha, Neb. Application filed July 24, 1899.

A suitable trolley head is combined with an internal gear fixed to each side of the trolley head, shafts passing through the internal gears, crank-shafts working upon the shafts, and drums provided with gears working upon the crank-shafts, the gears meshing with the internal gears to carry the drums in a radial path above and below the trolley head. (See cut.)

636,304. Apparatus for Effecting Silent Electrical Discharges. Alexander Vosmaer, Haarlem, Netherlands. Application filed March 30, 1898.

In the apparatus are a discharger consisting of a plurality of metal pins clamped between strips of metal, in combination with a flat or even plate against which the pins of the discharger are directly presented, and suitable electrical connections for the discharger and plate.

636,308. Device for Inflating Pneumatic Tires. John F. Wilson, Jetmore, Kan. Application filed December 5, 1898.

The device has an inclosing case, an air chamber therein, means to supply air to the chamber, a sliding bar having an electric contact point at one end thereof, a coin case provided with a chute to receive a coin, a block arranged to form electric connection with the contact point, and a lever adapted to register with a notch formed in the sliding bar.

636,313. Means for Controlling Railway Trains. Hermann Biermann, Breslau, Germany. Application filed March 9, 1897.

A means for controlling the speed of trains is described comprising a time clockwork, a co-operating clockwork, both located at a station, a line circuit controlled by a moving train and comprising conductors and a magnet for moving the co-operating clockwork in synchronism with the time clockwork, means for giving an alarm when the two clockworks are out of synchronism, a cab telephone, a station telephone, and means for connecting the telephones with the line circuit whereby conversation may be carried on.

636,318. Battery. Charles E. Burroughs, New York, N. Y., assignor to Norton P. Otis, Yonkers, N. Y. Application filed November 21, 1898.

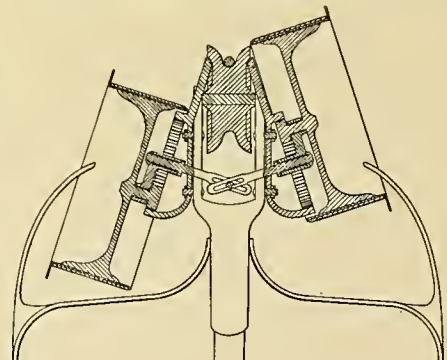
In the battery are combined inner and outer electrodes, the latter being expansible, a body of saturated absorbent material between the electrodes normally tending to expand the outer electrode, and means engaging the outer electrode to limit its expansion and thus hold the absorbent material under pressure in contact with both electrodes.

636,321. Electro-metallurgical Process of Extracting Native Copper. Thomas Craney, Bay City, Mich. Application filed November 30, 1898.

A process for mining native copper where it occurs in isolated masses or boulders is described which consists in making the mass or boulder the containing vessel and anode of an electrolytic cell by first forming a cavity therein and then electrolytically depositing the copper upon a cathode in presence of a suitable electrolyte.

636,327. Means for Supporting and Bracing Yard-arms for Arc Lamps, Etc. John R. Fletcher, Dayton, O. Application filed May 20, 1899.

A post is combined with an arm consisting of two sections, the inner ends of the sections being in contact with the opposite sides of the post, brackets upon which the inner ends are supported, brace-rods connected to one of the sections and to the post, adjustable brace-rods connecting the two sections of the arm, and means for supporting the adjustable brace-rods independently of the post, whereby tension may be applied thereto to tighten the sections of the arm in rigid contact with the post.



NO. 636,299.

636,336. Incandescent-lamp Holder or Receptacle. Gustav A. Harter, Chicago, Ill. Application filed March 4, 1899.

The invention consists of a series of lamp receptacles having their respective electrical contacts properly disposed and partly surrounded with a plastic material common to all.

636,358. Electric Arc Lamp. Rupert Scheibauer, Jersey City, N. J., assignor to the Sterling Arc Lamp company of New York. Application filed August 6, 1898.

In the lamp are combined feed-controlling magnets, a pivoted lever moved thereby, a pulley over which the carbon-carrying chain or cord passes, and a clutch consisting of a plurality of pivoted arms arranged around a center and adapted to be thrown toward the radii by the movement of the pivoted lever, an annular gripping surface against which the arms are thrust when moved, the gripping sur-

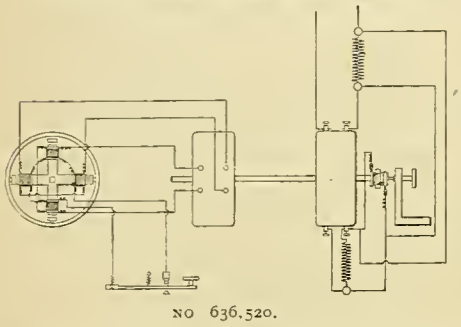
face being connected with the pulley, a tripping plate to which the arms are also pivoted and a yielding connection between the lever and tripping plate.

636,360. Electric Switch. Ferdinand Schwedtmann, St. Louis, Mo. Application filed March 15, 1899.

The switch has a spring-actuated switch-blade, a contact post provided with spring-strips for making contact with the switch-blade, a spring-actuated detent passing through one of the spring-strips and engaging the switch-blade, a handle pivotally mounted on the switch-blade and means carried by the handle for withdrawing the detent to release the blade.

636,366. Telephone System. Edward P. Trayer and De Elbert A. Reynolds, New York, N. Y. Application filed December 6, 1897.

Main-line conductors leading from the central station are combined with subscriber's apparatus arranged in multiple arc, each apparatus consisting of a telephone book held down by the weight of the receiver and carrying two circuit-closers, one for connecting the signal circuit momentarily during its upward release to the main line or ground, and the other for connecting the telephonic instruments to the coils of the inductorium, whose primary is connected to a local battery, the book being permanently connected to a main line through a retractile spring.



NO 636,520.

636,376. Electric Igniter for Gas Engines. Joseph S. Blackburn, Salem, O. Application filed February 17, 1897.

The igniter consists of a stationary electrode, a cylindrical casing, a piston-plunger operating against a spring therein and exposed to the pressure of the contents of the working cylinder, and a friction-jointed arm carried by the plunger and constituting an electrode.

636,379. Electric Cut-out. John Erikson, Providence, R. I., assignor of three-fifths to Byron T. Potter and Howard E. Barlow, Providence, R. I. Application filed February 11, 1899.

A safety cut-out is described which has a fusible wire, a transparent cylinder or case surrounding the wire, a filling in the cylinder that will be visibly changed by the fusing of the wire, a tube or case to inclose the wire and its cylinder, one or more openings made in the side or sides of the case, caps on the ends of the tube or case and wires connecting the fusible wire with the caps.

636,418. Toll-collecting Apparatus for Telephones. Henry G. Sweeney, Chicago, Ill., assignor to himself and Henry W. Fairbanks, Chicago, Ill. Application filed February 14, 1899.

The apparatus is adapted to be used with coins of different sizes and has a signaling device and means for energizing it, consisting of an electrically connected shaft operated by the patron and having a separate series of radiating fingers for each size of coin, and an electrical contact movable into contact with the series of the fingers which corresponds to the coin inserted in the machine.

636,420. Coin-controlled Mechanism. Alfred E. Watkins, Jersey City, N. J., assignor of seven-eighths to Bernard F. Seadler, New York, N. Y. Original application filed February 23, 1898. Divided and this application filed November 14, 1898.

A shoe-polishing machine is described which combines electrically operated devices for putting the machine into operation, adapted to be actuated by the dropping of a coin in a slot, a stop for the coin adapted normally to prevent the coin from actuating the devices, and means for withdrawing the stop in order to permit the coin to actuate the devices, operated by the placing of a shoe to be blacked in proper position in the machine.

636,429. Electric-lighting Apparatus for Vehicles. Gustavos Heidel, St. Louis, Mo., assignor to the Globe Electric company, St. Louis, Mo. Application filed February 13, 1899.

The apparatus has a casing, a lamp carried by the casing, a dynamo mounted within the casing, a friction roller adapted to bear against the rim of one of the vehicle wheels, and provided with connection to the armature shaft of the dynamo, a standard on which the casing is supported, a sleeve carried by the casing surrounding the standard and having a slotted head at its upper end adapted to receive a tongue carried by the casing, and a spring within the sleeve.

636,453. Electric Igniter for Gas Engines. John W. Raymond, Oil City, Pa., assignor to the Standard Automatic Gas Engine company, Oil City, Pa. Original application filed February 21, 1898. Divided and this application filed November 17, 1898.

The chamber of a gas engine is combined with two co-operating contacts arranged in the chamber, a rotary driving spindle arranged in the chamber and extending through an opening in the head thereof, a sleeve carrying one of the contacts and extending through the opening in the head, a clamping device whereby the sleeve is secured to the spindle, and a cap which closes the opening in the chamber head.

636,458. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed January 23, 1899.

In an electric switch are combined separable co-operative contacts, a pivoted lever, and a fixed guide so disposed that the engagement therewith of a projection of the lever in its rotary movement in one direction will cause the engagement of the co-operative contacts.

636,486. Electric Circuit-closer. Jacob J. Busenbenz, Chicago, Ill., assignor to the National Time Recorder company, Chicago, Ill. Application filed March 13, 1899.

The apparatus combines a rotatable chamber containing a relatively stationary contact, a contact-finger journaled in the chamber to turn independently thereof and weighted to sweep across the stationary contact in attaining its normal position controlled by the weight, and engaging means in the chamber movable therewith and into the path of which the weighted contact extends to be engaged and turned on its support.

636,492. Flash Lamp. Joshua L. Cohen, New York, N. Y. Application filed June 16, 1899.

A flashlight apparatus is described which comprises a casing to contain a battery, a detachable post supported by and having an electrical socket connection with the casing and a trough detachably supported on and having an electrical socket connection with the post.

636,505. Globe-holder for Electric Lamps. George W. Eddy, Waterbury, Conn., assignor to the Scovill Manufacturing company, Waterbury, Conn. Application filed July 19, 1899.

The holder comprises means to engage the shade, globe or the like, and a collar having a shoulder at one end to arrest its movement in one direction and at its other end having depending convergent gripping-lugs for automatically engaging some portion of the lamp, to secure the holder and shade.

636,519. Transmission of Sound. Elisha Gray, Highland Park, Ill., and Arthur J. Mundy, Newton, Mass. Application filed April 14, 1899.

A system of submarine telegraphy is described comprising a submerged bell for communicating signal vibrations or pulsations directly to the water and means for ringing the bell while submerged, by the direct action of magnetic lines of force pulsated at the vibrational rate of the fundamental tone of the bell.

636,520. Transmission of Sound and Device for Carrying Same Into Effect. Elisha Gray, Highland Park, Ill. Application filed June 23, 1899.

A bell is combined with a multiphase generator for directly producing pulsating lines of force to engender in the bell vibrations of the dominant tones of the bell, and means for governing the speed of the generator, whereby its pulsations may be set and maintained in accord with the vibrations of the dominant tones of the bell. (See cut.)

636,529. Motor Carriage. Edouard Henriquez, Brussels, Belgium. Application filed January 18, 1899.

In an automobile are combined with the driving-shaft, a hydrocarbon-engine, a motor capable of use as a dynamo, a switch, an accumulator, wires electrically connecting the motor dynamo, switch and accumulator, means for transmitting motion from the motor-dynamo to the driving shaft, means for transmitting motion from the hydrocarbon engine to the motor-dynamo, and means for simultaneously operating the switch and placing the hydrocarbon engine in engagement with the means for transmitting motion from the hydrocarbon engine to the motor-dynamo.

636,552. Means for Preventing Improper Manipulation of Air Brakes. William B. Potter and Frank E. Case, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed August 29, 1898.

Combined with an air brake are an electric brake, an actuator for the electric brake, an actuator for the air brake, and interlocking mechanism between the devices, such that the air brake will be operated when the electric brake becomes inoperative.

636,565. Safety Fuse. Joseph Sachs, New York, N. Y. Application filed November 14, 1898.

A tubular casing having closed ends and projecting terminals therein is combined with two fuse wires between and connecting the terminals, the one passing longitudinally through and within the casing between the closed ends and the other extending visibly along the outer surface of the casing between the terminals.

636,577. Electric Apparatus. Herbert W. Smith and William J. Baughman, Pittsfield, Mass., assignors to the Stanley Electric Manufacturing company, Pittsfield, Mass. Application filed April 10, 1899.

Combined in the apparatus are a pair of terminals, an inclosed arcing-space between them, an escape passage therefrom, and a spreading and chilling device over and adjacent to the escape passage to tend to interrupt the arc.

636,578. Thermal Cut-out. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 7, 1899.

The invention is an electric cut-out and comprises a conductor adapted to heat under a predetermined strength of current, and a body of an explosive acetylide compound in heat-conductive relation to the conductor.

636,604. Automatic Railway Signal. James M. Williams and Thomas P. Kinney, Danville, and Harry W. Kinney, Lynchburg, Va., assignors of one-fourth to James A. Henderson, Danville, Va. Application filed June 14, 1899.

The system comprises a gong-ringing mechanism, distant-track instruments, wires connecting the instruments with the gong-ringing mechanism, near-track instruments, wires connecting the near-track instruments with the gong-ringing mechanism, so that it may be actuated after the train has passed the crossing, means for ringing the gong and means for setting the gong-ringing mechanism in position to be actuated again by distant-track instruments.

636,638. Means for Intercepting Earth Currents in Electrical Traction. Walther Cramer, Hagen, Germany. Application filed August 19, 1899.

There is combined with an electrical tramway, the rails of which are used as return-conductors, a trough-like shield of good, electrically conductive material enclosing the track or the rails at a distance and in connection at the supply station with the same pole of the dynamo as that to which the rails are connected.

636,656. Electric Time Alarm. George E. Frank, Scranton, Pa., assignor of one-half to J. A. Lansing, Scranton, Pa. Application filed January 20, 1899.

In the apparatus are combined a casing, a cover-plate for closing the casing, a metallic face-plate supported outside of the cover-plate, the face-plate having a series of time graduations and a corresponding series of apertures therein, a clockwork mounted in the casing, a hand moved by the clockwork and located outside of the face plate, a series of removable pins adapted to enter the apertures in the face-plate and with which the hand contacts, and an electric circuit including an electric alarm and connected respectively with the clockwork and face-plate.

636,676. Sanitary Attachment for Telephone Transmitters. William Lenderoth, New York, N. Y. Application filed March 9, 1899.

An attachment is described which has a frame composed of a ring with arms extending outwardly therefrom and then bent to one side whereby they may be made to embrace and grasp the transmitter-cone, and bars secured to the ring at spaced intervals to form a skeleton cone, and a paper cone adapted to be inserted in the holder to form an auxiliary mouthpiece which is held thereby in front of the transmitter-cone.

636,685. Weight and Pressure-recording Apparatus. Edward McGarvey, Bellefonte, Pa., assignor of one-half to Guy C. Linn, Bellefonte, Pa. Application filed January 12, 1899.

A weight and pressure device are combined with a record strip, a vibrator controlled by an electric circuit, the circuit being controlled by the weight of pressure device, and devices for causing perforations through the record strip, the devices being controlled by the vibrator.

636,695. Burglar Alarm. Harman J. Pyle, Pueblo, Colo. Application filed June 27, 1899.

The poles of an electric circuit are respectively connected with two insulated parts of a safe or other structure. An electromagnet is located in the circuit and arranged to be energized when the circuit is closed and a spring actuated switch closes the circuit-path through the magnet or through a suitable alarm device.

636,704. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed July 8, 1899.

An open electric circuit including an electromagnet controls an elevating mechanism in the loom.

636,705. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed July 22, 1899.

Electromagnetic means are provided for controlling the vibrations of a shuttle carrier in the loom.

636,706. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed July 27, 1899.

In this invention electromagnetic means control the operation of the placer and the rotation of the shuttle-box of a loom.

636,707. Weft-supply Mechanism for Looms. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed August 14, 1899.

An electromagnetic device controls the time of operation of several supplying mechanisms in a loom.

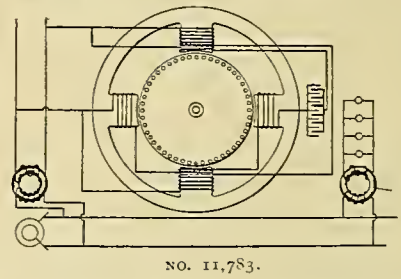
636,721. Advertising Apparatus. Willard H. Gilman, Boston, Mass., assignor to Frederick L. Milliken, trustee, Milton, Mass. Application filed August 28, 1897.

Incandescent lamps are used in the apparatus to illuminate a translucent pane or sheet bearing a picture or design.

Reissues.

11,783. Electric Motor. Thomas Duncan, Chicago, Ill. Application filed October 12, 1899. Original No. 623,528, dated April 25, 1899.

A motor for single-phase alternating currents is described which combines a plurality of poles. The magnetizing coils are mounted upon one-half of the poles in diametric arrangement and the phase-lagging coils are in series with the magnetizing coils and mounted upon the other half of the poles. A condenser is in series with both sets of coils, and a revolvable close-circuited armature is arranged in inductive relation to the energizing coils. (See cut.)



NO. 11,783.

11,786. Electromagnetic Brake. Frank C. Newell, Chicago, Ill., assignor to the Westinghouse Air Brake company, Wilmerding, Pa. Original No. 616,956, dated January 3, 1899.

An electric brake is described which has generators driven by the movement of the car, a brake magnet and automatically operated resistance mechanism comprising a plurality of coils each provided with a separate circuit and contact and a magnetically operated switch device co-operating with the contacts, whereby the resistance in the brake-magnet circuit is proportioned to the speed of the car.

Designs.

31,797. Switch Blade. George Christopher Herz, New York, N. Y. Application filed October 7, 1899. Term of patent, 3½ years.

31,798. Insulator. Frederick Henry Withycombe, Montreal, Canada, assignor of eleven-twentieths to Clement Henry McLeod, Montreal, Canada. Application filed September 15, 1899. Term of patent, 14 years.

31,799. Insulator. Frederick Henry Withycombe, Montreal, Canada, assignor of eleven-twentieths to Clement Henry McLeod, Montreal, Canada. Application filed September 15, 1899. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, NOVEMBER 25, 1899. No. 22

Three-phase Plant in the Elgin Watch Factory.

An interesting equipment of three-phase apparatus for lighting and power has been placed in Elgin, Ill., at the factory of the Elgin National Watch company. A direct-current lighting plant had been in use in the factory buildings for some time, but early in the present year it was decided to do away with some of the transmission shafting and several small engines that had been operated in different parts of the works and centralize the power plant, operating the line shafting in the individual departments by motors. Following this plan, the present plant was installed during the summer, and the old dynamos were taken out.

By means of the new plant three-phase alternating current is generated in the power house, the armature connection being what is known as the "star" or "Y" connection. Three wires lead from each point of the star and a fourth or neutral wire from the center. Between the three wires a pressure of 220 volts is obtained, while the voltage registered between the neutral wire and any one of the three wires is about 127 volts. This system permits the use of incandescent lamps on the 127-volt circuits and induction motors on the three-wire distribution.

Established some 35 years ago, the Elgin National Watch company has risen to be one of the leading watch manufacturers in the world, employing now about 2,300 operatives and having a daily output of about 2,000 watch movements. The grounds of the company cover 35 acres on the east bank of Fox River. The buildings consist of the large factory building, built with a number of wings, so as to afford an abundance of light to the employes, 12 detached buildings on the factory grounds, the National House, a four-story structure across the street from the main building and used as a boarding-house for the employes, and a gymnasium adjoining the National House. A view of the main factory building is shown in Fig. 4 on the next page. All of the buildings are constructed of cream-colored brick, with white-limestone trimmings and are finished inside with hardwood and Georgia pine. The main building has a frontage of 550 feet and extends back 425 feet.

The power-house structure, illustrated in Fig. 1, is connected with the wing extending back from the main entrance. There are installed in the boiler room 10 horizontal, fire-tubular, 80 horse power boilers, each 60 inches by 16 feet in size, which are arranged in two banks of five each. These boilers generate steam at about 90 pounds pressure for the engines in the engine room adjoining and are also used to help out the exhaust steam from the engines in supplying the heating system. Two Cochrane open heaters and oil separators are connected with the exhaust of the engines.

Water for the company's buildings is obtained from three artesian wells, the deepest being 2,000 feet. This water is pumped to an 80,000-gallon reservoir on a bluff east of the factory, whence it is piped to the buildings. In addition, the well water is supplemented by the city supply. A hot-water system supplies all the departments. Two hydraulic elevators are operated in the National House, the discharge water being conveyed to the boiler house and there used for boiler feed.

In the engine room, a general view of which is shown in Fig. 2, there are three belt-driven generating units. The generators are of the revolving-armature, General Electric type, and produce three-phase alternating current with a frequency of 7,200 alternations a minute. The two generators on the sides are 12-pole, 150-kilowatt machines, revolving at a speed of 600 revolutions a minute. The middle generator has a capacity of 50 kilowatts and is an eight-pole machine, with a speed of 900 revolutions a minute. Two simple horizontal Brown engines drive the 150-kilowatt generators. Each engine has a 16-inch cylinder with a 42-inch stroke and a speed of 102 revolutions a minute, with a rated capacity of 200 horse power. A 60 horse power, center-crank, simple Ball engine, with an 11-inch cylinder and 12-inch stroke, drives the 50-kilowatt generator. It operates at 273 revolutions a minute. Belted to each generator shaft is an exciter, with a capacity of 36 amperes at 125 volts. These exciters are driven at 1,100 revolutions a minute.

In rear of the Ball engine is located a vertical Allis condenser, with cylinders eight by 12 by 24

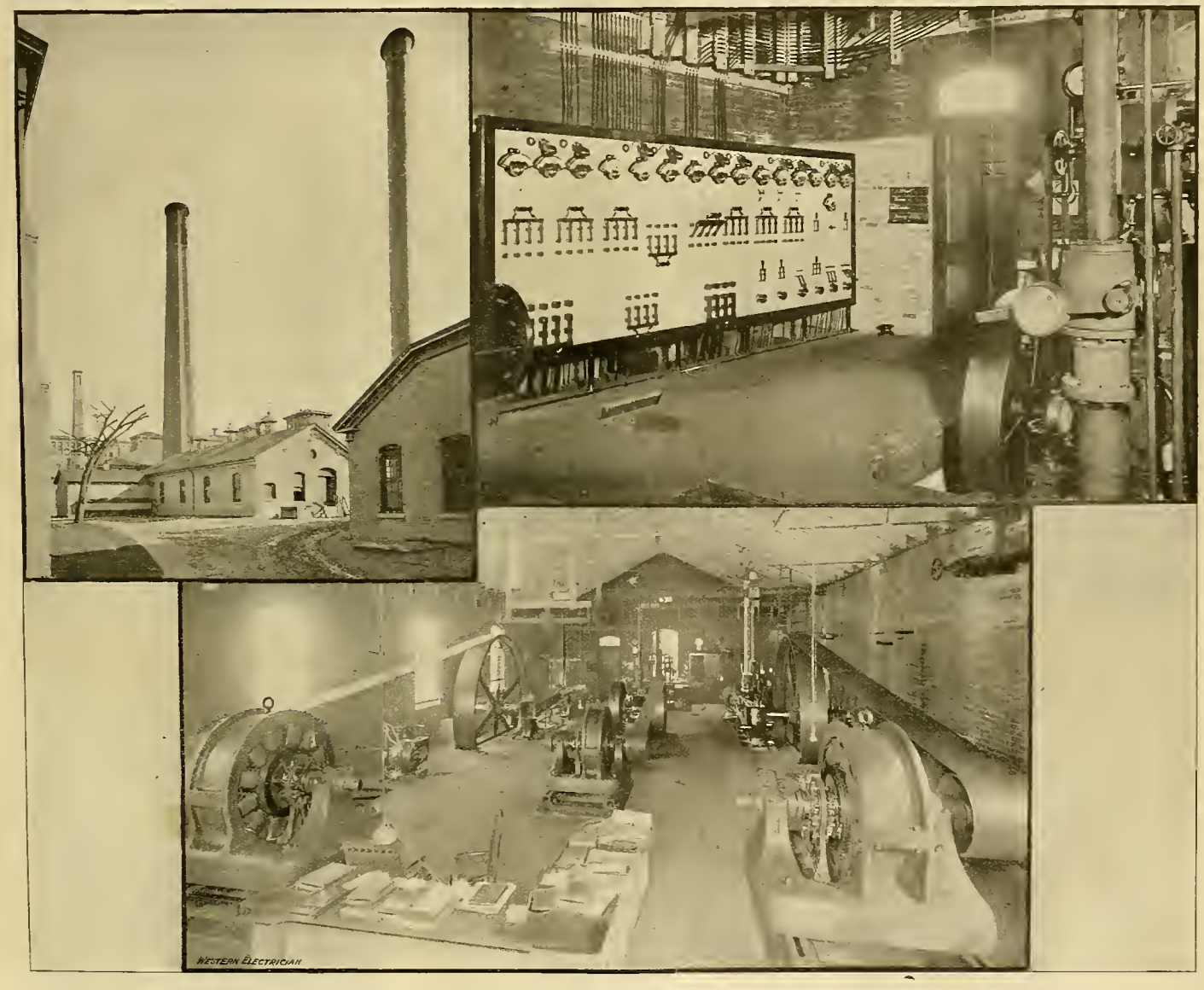


Fig. 1. Power Plant.

Fig. 2. Engines and Generators.

Fig. 3. Switchboard.

THREE-PHASE PLANT IN THE ELGIN WATCH FACTORY.

inches, with a Corliss valve gear. During cold weather the exhaust steam from the engines is turned into the heating mains, but during the summer the two Brown engines are run condensing by means of the Allis condenser. Fig. 3, which illustrates the switchboard, also shows a portion of the condenser. In another corner of the engine room is a 27 horse power Norwalk air compressor, with a compound air cylinder. Air is compressed by this machine at from 60 to 80 pounds pressure and is piped all over the factory buildings, where it is used in connection with many small machines to blow the tiny shavings and scraps of metal from the cutting tools. The engines are all equipped with Cochrane live-steam separators. A Holley loop gathers all the water from these separators and the high-pressure drips of the engines and auxiliaries and returns it to the boilers.

In Figs. 1 and 4 are shown three chimneys. The round steel stack is 150 feet high, with a seven-foot flue, and is brick-lined part way up. It was built three years ago to take the place of the 142-foot, five-foot-flue brick stack on the opposite side of the engine room. The latter stack is not used at present, but will probably be utilized soon in connection with the blacksmith shop. The third chimney, which is 100 feet high, is built of brick, and is used for ventilating purposes.

The switchboard, shown in Fig. 3, is built of pink Tennessee marble and consists of five panels. On the first panel from the left are three indicating ammeters, with scales reading up to 750 amperes, connected with one of the 150-kilowatt generators. A 600-ampere, four-blade switch at the bottom of the panel controls the generating current from the same machine. Panel No. 2 contains three indicating ammeters, with scales reading up to 200 amperes, and at the bottom a 200-ampere switch, all on the 50-kilowatt generator circuit. The third panel is a duplicate of the first, being connected

FIG. 4. ELGIN WATCH FACTORY.

with the other 150-kilowatt machine. On the fourth panel are three voltmeters, to indicate the voltage of the three generators, while on the last panel are three ammeters, connected with the exciters, and a voltmeter below, arranged by means of a switch to indicate the voltage of any one of the exciters. At the bottom of the fourth and fifth panels are located the exciter switches and rheostat handles. The eight switches at the center of the first four panels control the different circuits into which the distribution system is divided. In rear of the board are located the exciter and field rheostats and six small current transformers connected to the high-reading ammeters.

From the switchboard a few No. 0000 lead-covered cables lead to distributing centers in different wings, while the rest of the circuits are carried through the basement of the building with ordinary insulated wire. In all departments of the factory the motor installation follows a uniform plan. In each wing the motor is suspended from the ceiling and belted to a jackshaft, from which are belted the lines of shafting operating the machines in that section. In a factory of this nature there are so many small machines, some of which require three or four belts to drive them, that main and intermediate line shafting is considered indispensable. The installing of the electric motors does not, therefore, effect any saving of power in the individual wings, but, by doing away with the long lines of transmission shafting radiating from the power house to the separate wings, the motors afford a great convenience, for the reason that any one wing or department can be operated individually, and in case of a breakdown it is not necessary to shut down the entire plant.

As exceptions to the general rule of the motor installation may be mentioned the motors in the printing room and in the dial-transfer room. The former of these rooms is illustrated in Fig. 5. A five horse power induction motor is mounted on a shelf near the ceiling in one corner of the room and is belted to the shafting operating the presses. In this room is done nearly all the printing for the company. Fig. 6 shows one corner of the dial-transfer room. A one horse power motor, placed on the floor, drives a 500-ampere Mather electroplating machine, which furnishes current for the electroplating tanks, shown in the left of the illustration.

In the plate department, where the brass and nickel plates for the framework of the watch are finished, are located a 10 horse power and a five horse power motor. Fig. 8 (p. 309) shows the larger motor suspended from the ceiling and belted to the shafting.

In the press department a 10 and a five horse power motor are located. They are used to drive the power and drop presses which punch out in the rough all the blanks used in the watch. The five horse power motor, which is located in the north wing, in addition to the factory machinery, drives a worm-geared Ellithorp passenger elevator in the office building and also a dumb waiter. A view of the east wing of the press department, showing the 10 horse power motor and some of the presses, is given in Fig. 7.

A 10 horse power motor in the balance department drives the machinery used in making the balance wheels.

A carpenter shop occupies one of the detached buildings south of the main building. In the basement of the shop is a 15 horse power motor, which is used to drive a planer, molding machinery, band, cross and rip-saws and a large pipe-threading machine.

In the dial department, where all the dials are turned out, in addition to the one horse power motor mentioned above, a five horse power motor drives the dial-sinking and edging machinery and a one horse power motor an enamel-laying machine.

The enamel used is made in a separate building, near the carpenter shop. Here are located three melting furnaces and an annealing oven, with a five horse power motor driving a pressure blower for the furnaces.

The escapement department, in which the escapement of the watch is manufactured, is driven by two five horse power and two three horse power motors, each being in a different wing.

The engraving and gilding departments are located in one room. The engraving machinery consists of power presses, which stamp the names and numbers on the watch plates. In addition to the gilding, all the nickel plates are finished and ornamented by the damaskeening process in this room. A 10 horse power motor drives the machinery and also a small electroplating machine used in the gilding processes. Adjoining this room is a gilding-brush room, where a five horse power motor drives the brushes used to produce the satin finish on the watch plates.

The Elgin company designs and makes all its own machinery, tools and belts. The machinery department, where these machines are made, is divided into a building shop, operated by a 20 horse power motor (not suspended), and a repairing shop, driven by a 10 horse power motor. In these two shops the machines comprise planers, milling machines, engine lathes, etc.

In the main-spring department a 10 horse power motor drives the grinding and polishing machinery, and a three horse power machine in another part of the department operates the power presses that prepare the main springs for the braces and put them on and also drives the machinery in the adjoining department for the production of the leather belts used in the factory. A one horse power motor drives the hardening and tempering machines.

The largest suspended motor is illustrated in Fig. 9, which shows a portion of the stem-wind department. In this department is produced all the stem-wind mechanism and also all the screws used in the different movements. The motor illustrated has a capacity of 20 horse power. A 10 horse power motor and another of five horse power drive machinery in other wings of the department.

There is a five horse power motor in each of the north and south wings of the motion department and a 10 horse power in the east wing. This is the department into which the plates and all the material of the watch go to be fitted together. The jewels are also set in this department.

In the train rooms are made all the wheels and pinions, constituting the running parts of the watch. The machinery is driven by a five and a 10 horse power motor.

To the timing department all the movements are sent from the finishing rooms, and after being

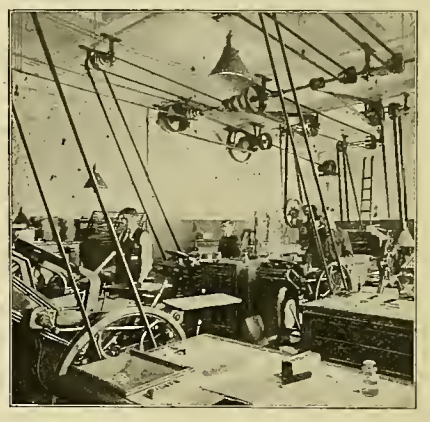


FIG. 5. THREE-PHASE PLANT IN THE ELGIN WATCH FACTORY.—PRINTING OFFICE.

timed and adjusted they are ready for packing and shipment. A one horse power motor in this department drives a few small lathes and other machines for miscellaneous work.

In addition to the motors mentioned above, there is placed in a small room adjoining the boiler room a 10 horse power motor, which drives a ventilating fan and a pressure blower for blowing the enamel furnace, blacksmith forges, and steel-tempering and annealing furnaces.

A three horse power motor in the National House runs a dish-washing machine, an ice-cream freezer and a coffee mill in the kitchen.

All told, the establishment is equipped with 33 induction motors, ranging in size from one to 20 horse power, the combined capacity being 231 horse power. The company relies on the electric drive exclusively, the machinery in all departments being driven by the motors.

Throughout the buildings there are upward of 4,500 incandescent lamps. Some of the lamps are of eight and 10 candle power, but the larger portion are rated at 16 candle power. The National House and the gymnasium are heated, lighted and supplied with hot and cold water by the company's plant. The station of the Chicago and Northwestern railway, shown prominently in Fig. 4, is also heated and lighted from the power house. Residences occupied by the superintendent, the two assistant superintendents and the cashier of the Elgin company, in the immediate vicinity of the factory, are lighted from the company's plant.

The Grinnell automatic fire system of water piping has been installed in all parts of the factory. Sprinkler heads are spaced about eight feet apart and are provided with composition plugs, which melt

FIG. 6. THREE-PHASE PLANT IN THE ELGIN WATCH FACTORY.—ELECTROPLATING APPARATUS IN DIAL-TRANSFER ROOM.

at 155 degrees, thus allowing the water to be sprayed over the room. Electric-alarm devices are connected with every riser, which indicate when there is water flowing in that particular pipe. The system of piping is shown in several of the illustrations.

The design of the three-phase equipment is credited to F. P. Mack, consulting engineer, and George E. Hunter, assistant superintendent of the Elgin National Watch company. The entire plant was installed under the personal supervision of Mr. Hunter, the generators, motors and switchboard equipment being furnished by the General Electric company.

Naval Board Approves Marconi System.

Although it was supposed that the tests of Marconi's wireless telegraph on the Massachusetts and New York were not entirely successful, from a naval point of view, the board of officers ordered to report on the trials recommends that the system be given a trial in the navy. The inspecting board consisted of Lieutenant-commander J. T. Newton, Lieutenant J. B. Blish and Lieutenant F. K. Hill, and their report is as follows:

"We respectfully submit the following findings as the result of our investigation of the Marconi system of wireless telegraphy:

"1. It is well adapted for use in squadron signaling under conditions of rain, fog, darkness and motion of ship. The wind, rain, fog and other conditions of weather do not affect the transmission through space, but dampness may reduce the range, rapidity and accuracy by impairing the insulation of the aerial wire and the instruments. Darkness has no effect. We have no data as to the effects of rolling and pitching, but excessive vibration at high speed apparently produced no bad effect on the instruments, and we believe the working of the system will be very little affected by the motion of the ship.

"2. The accuracy is good within the working ranges. Cipher and important signals may be repeated back to the sending station, if necessary to insure absolute accuracy.

"3. When ships are close together (less than 400 yards) adjustments (easily made) of the instruments are necessary.

"4. The greatest distance that messages were exchanged with the station at Navesink was 16.5 miles. This distance was exceeded considerably during the yacht races, when a more efficient set of instruments was installed there.

"5. The best location of instruments would be below, well protected, in easy communication with the commanding officer.

"6. The spark of a sending coil or of a considerable leak due to faulty insulation of the sending wire would be sufficient to ignite an inflammable mixture of gas or other easily lighted matter, but with the direct lead (through air space, if possible) and the high insulation necessary for good work no danger of fire need be apprehended.

"7. When two transmitters are sending at the same time, all the receiving wires within range receive the impulses from transmitters, and the tapes, although unreadable, show unmistakably that such double sending is taking place.

"8. In every case, under a great variety of conditions, the attempted interference was complete. Mr. Marconi, although he stated to the board, before these attempts were made, that he could prevent interference, never explained how nor made any attempt to demonstrate that it could be done.

"9. Range of signaling: Between large ships (heights of masts 130 to 140 feet above the quarter-deck) the range is at least 35 sea miles at sea and 16.5 miles or less when tall buildings of steel frames interfere. Between a large ship (height of mast, 140 feet) and a torpedo boat (height of mast, 45 feet), across open water, signals can be read up to seven miles on the torpedo boat and 8.5 miles on the ship. Communication might be interrupted altogether when tall buildings of iron framing intervened.

"10. The rapidity is not greater than 12 words per minute for skilled operators.

"11. The shock from the sending coil of wire may be quite severe and even dangerous to a person with a weak heart. No fatal accidents have been recorded.

"12. The liability to accident from lightning has not been ascertained.

"13. The sending apparatus and wire would injuriously affect the compass if placed near it. The exact distance is not known, and should be determined by experiment.

"14. The system is adapted for use on all vessels of the navy, including torpedo boats and small vessels, as patrols, scouts and dispatch boats, but it is impracticable in a small boat.

"15. For landing parties the only feasible method of use would be to erect a pole on shore and then communicate with the ship.

"16. The system could be adapted to the telegraphic determination of differences of longitude in surveying.

"The board respectfully recommends that the system be given a trial in the navy."

Mr. Marconi, in a letter dated October 29th, explained why he could not give any demonstration of his non-interference devices. His experiments with wireless telegraphy on the New York and Massachusetts were interrupted because of the outbreak of the Boer war. Signor Marconi wrote: "Having consulted with my partners, I regret to be unable to give a demonstration of devices I use for preventing interference and of the system employed for tuning or syntonizing the instruments. The reasons why I cannot give such demonstrations are: The means employed are not yet completely patented and protected; insufficient materials and instruments are here with me to give full demonstrations; no detailed information from the United States Navy Department was received by my company prior to my departure from England as to the extent of demonstration required. Therefore, the instruments sent here were solely those necessary for carrying out our contract with the New York Herald and sufficient for government tests, but not on a large scale."

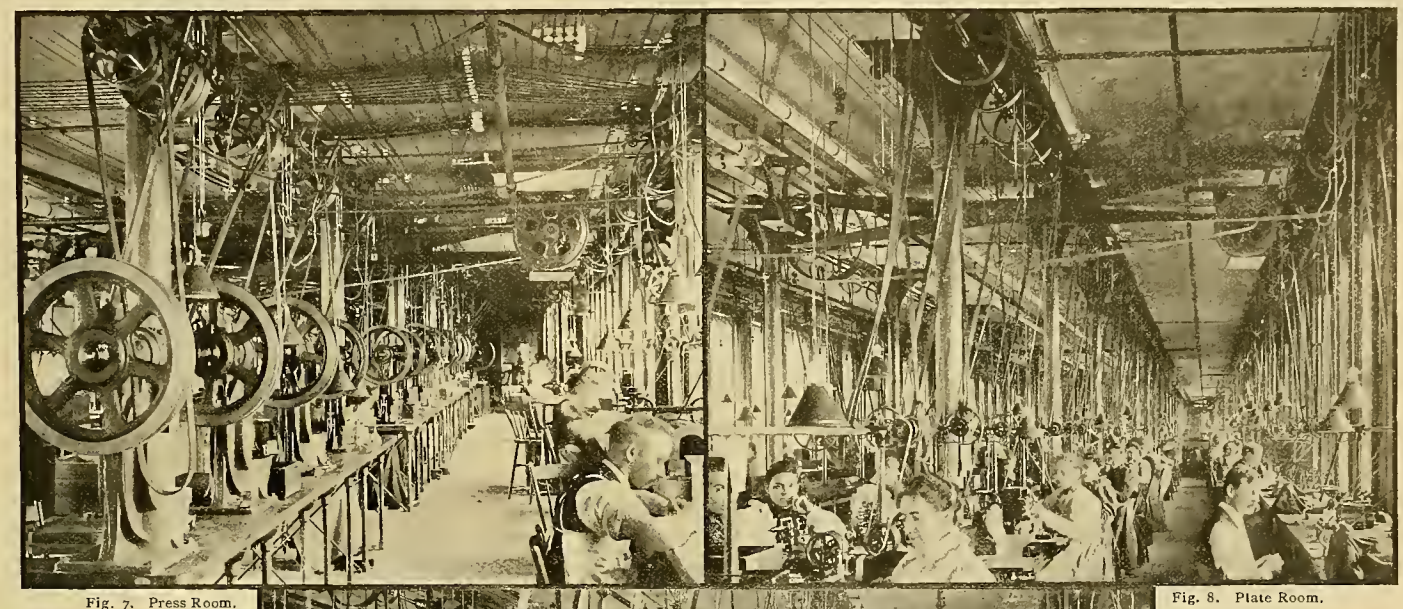


Fig. 7. Press Room.

Fig. 8. Plate Room.

Fig. 9. Stem-wind Department.

THREE PHASE PLANT IN THE ELGIN WATCH FACTORY.—MOTORS DRIVING LINE SHAFTS.

The Board of Supervisors of Kane County, Ill., has granted a 50-year franchise to the Chicago, Wheaton and Aurora Railway company, to build and operate an electric line in that county.

Compensated Revolving-field Generators.[1]

By H. G. Reist.

It is well known that when the load on an electric generator, direct or alternating, is increased, the potential will drop unless the field excitation is also increased. This is due to the resistance and the inductance of the armature and the reaction of the armature on the field poles, the latter reducing the amount of effective magnetic flux. The potential at a distant point, where the current is used for lights or motors, falls even more on account of the resistance and inductance of the line. To compensate for the drop of potential direct-current dynamos have been compounded by passing the main current through series coils on the poles and so adjusted that the potential at the machine increases with increasing load. On alternating and multiphase machines the same result has been obtained by rectifying the main or an induced current and using it for the same purpose, and, except for a slight increase in complication, the method is just as effective as on direct-current machines, so long as the alternating current is in phase with the potential, which, unfortunately, is rarely the case in ordinary operation, since partly loaded transformers and induction motors produce a lagging current which requires a greater field excitation to produce the normal potential. This has not heretofore been provided for except by hand regulation, but is, in the case of the machines to be described, entirely automatic.

The line of machines as developed and now being built is belted and will fill the wants of installations where the greatest trouble is experienced, i. e., where the size of the motor units is likely to be a large per cent. of the size of the generator units.

The design is based on a principle radically different from anything which has heretofore been employed. The new feature is the method of excitation, and gives an automatic compounding far superior in results from that which can be obtained by any other known method, and at the same time there is nothing but the simplest and most reliable mechanism used.

The distinctive advantage of this method of compounding is that it automatically adjusts the potential for all variations and degrees of inductive and non-inductive load without any mechanical change or adjustment. In any alternator, to maintain a given potential with a given inductive current requires a larger amount of field excitation than is needed with the same potential and load if the current is non-inductive. Thus, in all types of alternators heretofore designed the compounding required for non-inductive loads has been entirely insufficient for inductive conditions. With the loads that ordinarily have to be provided for on alternating-current circuits there are wide variations in the power factor, especially in cases where a considerable proportion of the load is in motors. Con-

1. Read before the Ohio Electric Light association, October 11, 1899. Mr. Reist is a designing engineer for the General Electric company, and the machine described is built by that company.

sequently, the achievement of an automatic means of field adjustment for all kinds and degrees of load is of the greatest practical value.

Method of Compounding.—The shaft of the alternator which carries the revolving field also carries the armature of the exciter, which has the same number of poles as the alternator, so that the two operate in synchronous relation. Besides the exciter commutator and the pair of collector rings which deliver current to the field of the alternator, the shaft carries three other collector rings, which are connected to taps in the exciter winding, in the same manner as the rings are connected to the winding of rotary converters. By means of these collector rings the exciter receives current from one or several series transformers inserted into the lines leading from the alternator. This alternating current, passing through the exciter armature, reacts magnetically upon the exciter field in proportion to the strength and to the phase relation of the alternating current. In consequence thereof, the magnetic field and, hence, the voltage of the exciter are due to the combined effect of the shunt field and the magnetic reaction of the alternating current. This current passes through the exciter armature in such a manner as to give necessary rise of exciter voltage as the non-inductive load increases, and without other adjustment to give a greater rise of exciter voltage with additions of inductive load.

The connections between the armatures of the two machines are so made that the polarities induced in the exciter armature are somewhat ahead of the exciter-field magnetization, but still so that it will assist the field magnets. The result is that with increasing main current the current passing through the exciter armature strengthens the exciter fields and thereby the fields of the generator. If the current lags, as under an inductive load, the magnetization produced by the alternating current in the armature comes more nearly in line with the exciter-field magnetization, thus strengthening the field more with a given line current. These are the first machines in which this result has ever been accomplished and they are, consequently, the only perfectly compounded alternators. They accomplish the desired result with wonderful accuracy and without any liability to sparking or trouble of any kind.

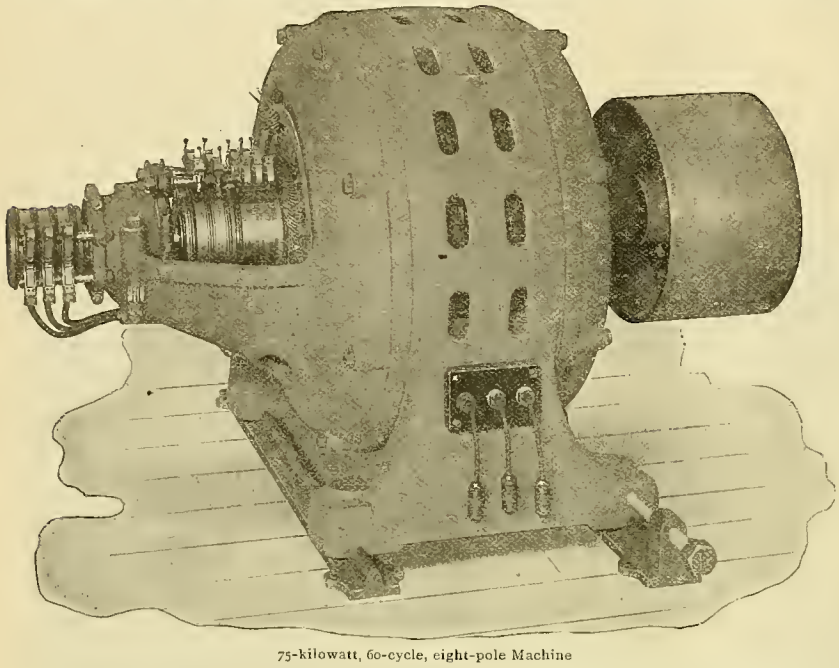
Accessories for Excitation and Compounding.—The commutator and all the collector rings are fitted with carbon brushes and all operate at pressures below 75 volts, so that all parts may be freely handled under all conditions. Each ring is fitted with two brushes, so that any brush may be removed for examination or repair without disturbing the operation of the machine. The same remarks apply to the commutator brushes, of which there are three in a set on the smaller machines.

No alternating current is rectified, as in other compound alternators, and no conditions exist which will produce trouble through sparking or improper brush action. In fact, one of these machines requires no more care than that which is generally bestowed upon the exciter of a separately excited alternator.

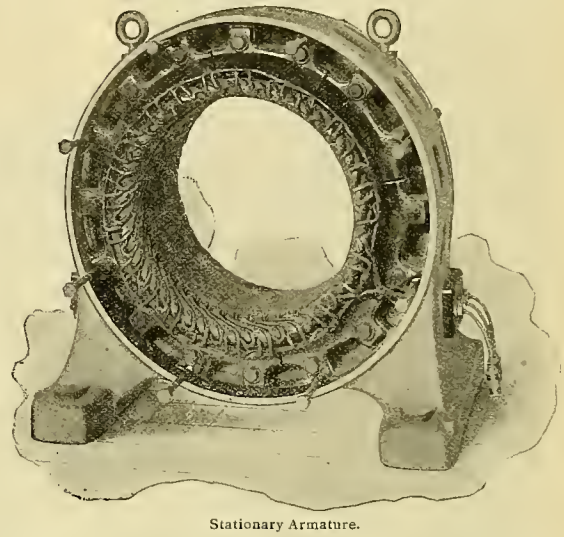
With each alternator is furnished a transformer of compact design, for the purposes described above and a small rheostat, which is connected in series with the exciter-field winding. These can be mounted wherever convenient. No other accessories are required with the machine except such switchboard arrangements as the service may demand.

The Dynamo Proper.—The machine is of the revolving-field type, with stationary distributed armature winding, the design being such that a vigorous ventilation is maintained through all parts.

The armature coils are insulated by the same methods used in making coils for high-potential machines and their construction is far superior to any other which has been put in practice. The coils are held in place by means of wooden wedges; this allows the coils to be easily removed and has been found very satisfactory fastening in the vast amount of machinery built in this way. The poles of the revolving field are built up of laminations and are fastened into dovetailed slots in the steel hub with taper keys. These keys are easily driven out, so there is no trouble to remove or replace a pole-piece. The field coils are made of flat-strip copper, wound on edge, each coil consisting of a single spiral. Paper is used to insulate between successive turns, and insulating collars are used at the ends of the coils. When the coils are clamped into place by fastening of the pole-piece, a very substantial and handsome structure is produced. The potential between adjacent turns amounts only to a fraction of a volt, so that the insulation is extremely safe.



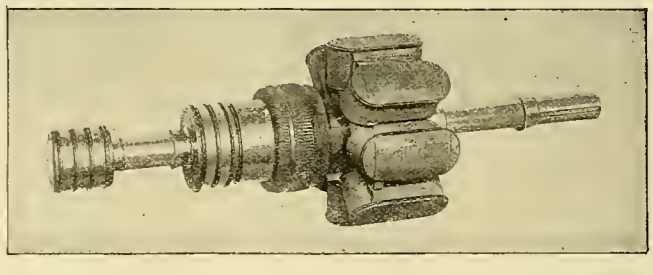
75-kilowatt, 60-cycle, eight-pole Machine



Stationary Armature.

COMPENSATED REVOLVING-FIELD GENERATOR.

Mechanical Arrangement.—The mechanical design of these machines is very compact and convenient. All parts are readily removable. The distribution of weight and pull is such as to give a particularly good action in bearings. The bearings are self-oiling and aligning and of ample size. The pulley is brought well over the pulley bearings to save room and needless pressure in the bearing adjacent. The exciter fields are mounted on the shield of the generator. The machines stand on rails, so that the belt tension can be adjusted. There are two connection boards, the one on the right of the machine being used for the main terminals of the machine. These terminals for all potentials above 500 volts are covered with hard-rubber covers, so that there are no bare high-potential conductors.



COMPENSATED REVOLVING-FIELD GENERATOR.—REVOLVING FIELD AND EXCITER ARMATURE ON SAME SHAFT.

The board on the left of the machine has terminals for the exciter-field rheostat and for the secondary terminals of the series rheostat.

Efficiency.—These dynamos are so proportioned as to afford particularly effective use of all the magnetic material. The efficiencies obtained are consequently high and the weight of the machines per kilowatt output is small. By the use of a direct-connected exciter the belt and bearing losses of that machine are eliminated, and by properly proportioning the parts it is possible to dispense with the wasteful rheostat in the alternator fields. Actual tests show that the efficiencies of these machines are higher than those of standard belt-driven alternators.

Phases and Voltages.—Our standard designs for these machines are adapted to three-phase or two-phase windings without change, save in the coils themselves, the exciter and all accessories being the same for both. We have not standardized any single-phase or monocyclic windings for these machines, our intention for the present being to use three-phase windings for cases for which monocyclic or single-phase machines would ordinarily be required.

These machines will carry their full rated capacity, two or three-phase non-inductive load continuously with a rise of temperature not to exceed 40° Centigrade in any part, and will carry 25 per cent. overload for two hours without rise of temperature exceeding 55° Centigrade above the surrounding air. All machines with three-phase windings are guaranteed to carry 80 per cent. of their rated output in single-phase current. Under these conditions the same temperature guarantee can be given as for two and three-phase rating. We will also guarantee that these machines with three-phase windings will carry their full-load output in single-phase current for a period of three hours without injurious heating.

Application to Lighting and Power Distribution.—The machines can be operated at their full three-phase rating when they are used to deliver power for both lighting and motor service with the lighting distributed from one phase only and the motors connected to all three-phases. The machines can be operated in this way where the lighting load is a large proportion of the whole. The reason for this is that the motors tend to draw most of their power from the phases which operate at the highest voltages; consequently, the motors tend to correct the unbalanced condition that arises from the operation of lights from a single-phase. This is of great practical value, as a single-phase current is for many reasons more convenient than a polyphase current for lighting purposes.

While this method of operation is recommended for many installations, the machines are, of course, practically adapted to any system of polyphase-lighting distribution. The machines have been so designed that they can be wound for the following potentials: 480, 600, 1,150, 2,300 and 3,450 volts, for three-phase windings; 480, 1,150, 2,300 and 3,450 volts for two-phase windings.

Machines with three-phase windings and arranged for 2,300 volts will be considered our standard and can be more promptly delivered than for any other arrangement of windings and potentials.

Operation.—I would now like to say a word regarding the behavior of the machines in practice. I have seen a 50 horse power induction motor started from a 75-kilowatt generator with a drop in potential on the line just sufficient to fluctuate the voltmeter and lasting, perhaps, one-half second, but the effect on the lights could be detected only on close observation. At the same time it was noted by the tachometer on the machine that there was a momentary drop in speed, so that beyond a doubt the slight fluctuation was due to this cause.

COMMUNICATION.

Prices of Material Wanted.

To the Editor of the Western Electrician:

I am contemplating the erection of an electric-light plant. I shall need a 50 horse power engine and boiler, a dynamo of 500 or 600 lights' capacity, as well as wire, poles, lamps and everything necessary for a plant of that size. I will be pleased to get prices on this material. LEWIS C. MOE.

St. Ansgar, Ia., November 18, 1899.

Surveys for Pacific Cable.

In his annual report to the secretary of the navy, Rear-admiral Bradford, chief of the Bureau of Equipment, reports on recent naval surveys for a trans-Pacific cable. He says:

"A practicable route for a submarine telegraph cable was established between San Francisco and Honolulu some years ago. In order to continue the survey of the route from Honolulu to the Philippines, the United States steamer Nero, under Commander Charles Belknap, United States Navy, was very thoroughly fitted out and equipped for deep-sea exploration at the navy yard, Mare Island, during the early part of the present year. The Nero is a large steam collier purchased for use during the late war, and on account of her great steaming radius was admirably adapted to make the survey. After a careful consideration of the subject it was decided that the best route westward from Honolulu to the Philippine Islands was by way of the Midway Islands and Guam, landing the cable at a convenient point on the east coast of Luzon, as near as possible to the latitude of Manila. It was also decided as desirable to survey a route from Guam to Yokohama. Elaborate instructions for the survey were prepared. The plan of the survey consists in carrying direct lines of soundings, taken at alternate intervals of 10 and two knots, from Honolulu to the Midway Islands, thence to Guam, and thence to Luzon, and also from Guam to Japan. The return course to be pursued is a zigzag line, passing back and forth to equal distances on each side of the route followed in going to the westward, with soundings at intervals of 20 knots at the turning points.

"The Nero sailed from San Francisco for Honolulu on April 22d. She sailed from Honolulu to commence her work on May 6th. On May 22d she had completed a single line of soundings to the Midway Islands; by July 4th to Guam, and by August 1st to Luzon.

"Along this route, which is 4,812 knots in length, 853 soundings were taken. The characteristics of the bottom soil and the temperature of the surface water were observed at each sounding station, and these, together with the meteorological record of the frequent observations of specific gravity, bottom temperature and the currents of the ocean, besides their value in laying a submarine cable, will form an important contribution to the physics of the Pacific Ocean.

"Two offsets from the projected great-circle route between the Midway Islands and Guam were found to be necessary in order to avoid obstacles to a successful laying and operation of a telegraph cable. The first of these obstacles encountered is a submarine mountain situated a short distance westward of the Midway Islands, and rising from the floor of the ocean, which here sinks to a depth of 2,200 fathoms, to within 82 fathoms of the surface. The second obstacle is one of the deepest submarine abysses yet found in the world, situated about 500 miles eastward of Guam and sinking to a depth of more than 4,900 fathoms. Reports have been received of the preliminary line of soundings from Honolulu to Luzon, and they indicate that the route which is being surveyed will prove entirely practicable. No reports of the soundings taken on the return trip or of any soundings from Guam to Yokohama have been received. The expenses of this survey, so far as this bureau is concerned, have been entirely defrayed from its current appropriations."

A map of the cable route is given with the report. To secure more information about the Midway Islands Admiral Bradford is now fitting out the ocean-going, twin-screw naval tug Iroquois, with surveying apparatus, at Honolulu, to make a thorough examination of the reefs surrounding the Hawaiian archipelago. At the same time the Yosemite is making an exhaustive investigation of Guam, and the Bennington, which is equipped with surveying outfit, will chart the coast of Luzon, near Dingalan Bay, where it is proposed to land the Manila end of the cable.

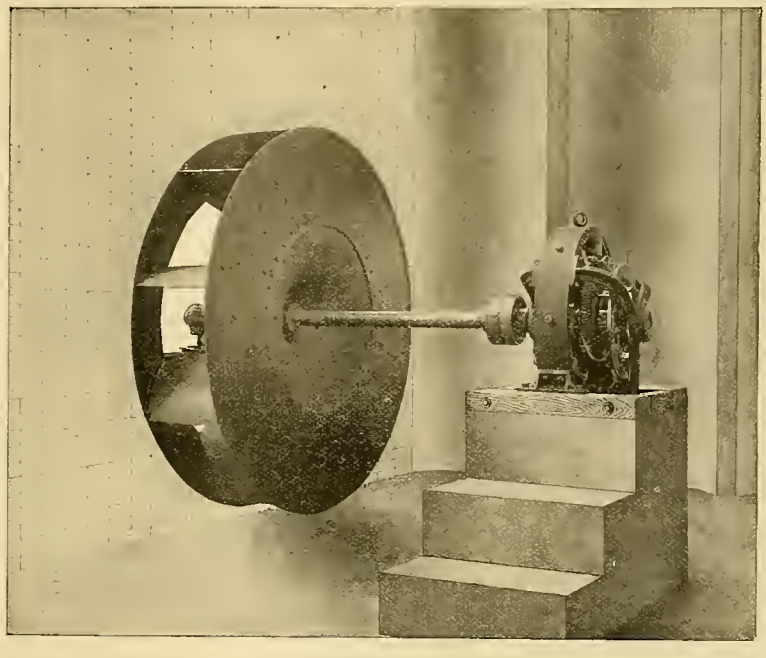
Electric Railways in Michigan.

The Michigan Labor Bureau has completed the canvass of the 19 electric railways in operation in the lower peninsula. The three lines in Detroit, being practically under one management, are considered as one line, their business aggregating nearly 50 per cent. of all lines canvassed. The Adrian line is the smallest in the state, but improvements and extensions contemplated will soon place it on a different basis. The aggregate capital stock is $14,045,000, the average being $739,210. The largest is that of the three combined roads at Detroit, $7,000,000, and the smallest is at Adrian, $20,000. The aggregate number of miles of road operated is 448, Detroit having 101 and Adrian three. The aggregate number of cars operated is 456, an average of 24. The total number of employes in operating departments is 1,629, the average being 89. Detroit has 680. The aggregate monthly pay-roll for operating departments is $87,879; average, $4,625. Detroit's is $35,000 and Adrian's $260. Nearly every company reports that extensions and connections are either being made or are contemplated. The labor inspectors have canvassed 1,020 street-railway employes relative to age, nativity, number dependent upon them for support, effect of work on health, wages received, savings, etc. The results will appear in a separate bulletin

Ventilation of the Boston Subway.

In the past the ventilation of railroad tunnels or subways has had for its principal object the removal of smoke and gas discharged by the locomotives employed for traction purposes. But with the advent of electric power and its wide application to street-car propulsion, the most important objection to underground transportation has been removed.

Nevertheless, there still remains, as has been clearly demonstrated in the Boston subway, the necessity of a positive and continuous change of air for the double purpose of maintaining its purity and of so regulating its humidity as to prevent the deposition of moisture and the consequent chilling of passengers and employes. The latter feature is of the utmost importance, as is readily shown by the fact that the dew-point of air of 90 degrees temperature having a relative humidity of 70 per cent. is about 79 degrees. That is, if with an external temperature of 90 degrees there be but a slow and uncertain movement of the air within the subway, it may be readily cooled through 10 degrees or more, thereby become saturated, and not only cause great inconvenience by the constant dripping from all structural work, but become a positive menace to health. A rapid change of air, such as may be secured by mechanical means, serves to equalize the internal and external temperatures and to prevent the maintenance of a humid atmosphere. At the present time, periodical readings of temperature and humidity are being taken under the direction of the Boston Transit Commission, and the results will undoubtedly appear in a forthcoming report.



VENTILATION OF THE BOSTON SUBWAY.

The original designs of the commission contemplated the introduction of electrically driven fans at suitable points along the route. Four of these have already been installed by the B. F. Sturtevant company of Boston, two near West street and two between Hollis and Eliot streets. The former location is practically midway between the Boylston and Park street entrances, at each of which there is ample opportunity for the free ingress of air. The space coming under the control of the fans at this point is about 1,050,000 cubic feet. The Hollis and Eliot street section contains about 900,000 cubic feet.

The fans were, in each case, designed to have a capacity equivalent to an air change in each section once in about 15 minutes The illustration shows one of the fans at the West street chamber. The air is drawn from the subway and forced through the chamber to a point above the surface of the ground.

The fans are all of the Sturtevant cone type, each consisting of a cast-iron conoidal center, with annular back plate of steel attached thereto, and a series of reverse-curved steel-plate blades or floats, tapering from inlet to periphery, attached to the annular back plate and to the front plate containing the inlet opening. In its course through the fan the direction of the air is gradually changed from axial to radial, the curvature of the blades being such as to offer the least resistance to the passage of the air and to secure the highest efficiency.

The two fans between Hollis and Eliot streets are each seven feet in diameter, and each one was designed to deliver 30,000 cubic feet of air a minute, when operated at 175 revolutions a minute, and to require an expenditure of about seven horse power for its operation under ordinary atmospheric conditions. At one-half the speed the power expenditure will be about one horse power. Both of these values will naturally vary with the density of the air and the existing temperatures within and without the subway. The two fans near West street are both eight feet in diameter, each designed to deliver 37,000 cubic feet of air a minute at 170 revolutions, with a power expenditure of about 10 horse power, and to require 1.25 horse power when driven at half speed.

Each fan is provided with an electric motor of special Sturtevant type, direct-connected to the fan shaft by an insulated coupling. The armatures are of the drum type, thoroughly ventilated and rendered moisture-proof by being saturated in japan and thoroughly baked after having been effectually insulated with mica and oil-cloth. The motors are shunt-wound for maximum speed at 550 volts and arranged for series or parallel operation, having a starting and regulating resistance giving different speeds for each combination. The maximum temperature rise for 10 hours' continuous operation is limited to 45 degrees Centigrade for the armature, and to 50 degrees Centigrade for the commutator or fields.

Each motor is mounted on a substantial insulating base frame, constructed of Southern hard pine and thoroughly filled to prevent absorption of moisture, and anchor-bolted to the concrete foundation.

Effect of Electricity on Animal Growth.

The Detroit correspondent of the Western Electrician writes that Professor W. J. Herdman of the University of Michigan recently established the fact that by treating animals with electricity, under certain conditions, the growth could be increased. The animals experimented with were rabbits and guinea pigs. As soon as the animals were old enough to be weaned, they were divided into groups as nearly alike in age and weight as possible. The two bunches were placed in conditions of living in all respects similar, except that one group was treated in a cage through which an alternating current passed for a period of six hours each day. When the time expired for the animals to get growth it was found that the electrically treated animals had gained from 18 to 24 per cent. at the end of each succeeding week.

Now Professor Herdman has made just as important a discovery. He has been investigating the depressing effect by applying a stronger and more lasting current, and it shows that growth can be retarded. His experiments demonstrate that up to a certain period the animals will increase their normal weight, and then the curve will decline rapidly for the depressing effect.

Dr. Herdman has no doubt that with human beings treated continually from babyhood up the same results could be obtained.

Electric Vehicle Said to Have Run 100 Miles.

An experiment was made on November 17th in the vicinity of Atlantic City, N. J., which will interest those watching the development of the automobile, and especially the electric vehicle. An automobile in charge of Hiram T. Maxim and J. B. Entz is asserted to have covered a distance of 100 miles in seven hours and 44½ minutes, including rests and stops, which amounted to about 20 minutes, with but one charge of the battery. It is said that so far as known this beats the record claimed in France, where, it is stated, an automobile made a trip of 85 miles with no recharging. Including the passengers, the total weight of the American machine was 2,500 pounds.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new, should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Several interesting points are made in the finding of the board of officers appointed to report on the tests of the Marconi wireless-telegraph system for use in the navy. One is that the spark of the sending coil might ignite inflammable material, although with proper precautions no danger of fire need be apprehended; another is that the speed of transmission is not greater than 12 words a minute; a third is that quite a severe shock may be received from the sending coil; still another is that the apparatus will affect a compass if placed too near it; and the greatest objection of all was that when two transmitters are sending at the same time, all the receiving wires within range receive the impulses from transmitters, and the tapes are unreadable. "In every case," says the board, "under a great number of varied conditions, the attempted interference was complete. Mr. Marconi, although he stated to the board before these attempts were made that he could prevent interference, never explained how nor made any attempt to demonstrate that it could be done." Nevertheless, the advantages of the system outweighed the defects, and the board recommended that the apparatus be given a trial in service. The accuracy was good within the working range, which was 16½ miles at the tests, and the system was well adapted for use in squadron signaling. It is likely that the Navy Department will adopt the recommendation of its officers, and it may be that the time is not far distant when every naval vessel will be equipped for space telegraphy.

The scientific investigations of Mr. H. L. Doherty, the young and energetic president of the Northwestern Electrical association, have won him unexpected renown in England, as may be learned from the following from the Electrical Engineer of London: "A well-traveled paragraph appears in the Globe column headed 'Echoes of Science.' In the course of its travels the paragraph in question has become somewhat changed, as we were not aware, in the first instance, that Mr. Doherty possessed the knowledge for transmuting clay into iron. The paragraph reads as follows: 'Mr. H. L. Doherty, president of the Madison (Wis.) Gas and Electric company, Milwaukee, has proposed the use of vitrified-clay pipes for iron gas mains. They would be cheaper, more durable, less porous, and have other advantages over iron pipes.'" Like all residents of the state of Milwaukee, Mr. Doherty is ingenious, but it is to be doubted if he asserts the ability of a thaumaturgist.

A word of appreciation is due the work done by the Bureau of Foreign Commerce of the Department of State. This bureau, among other duties, issues daily "Advance Sheets" of the reports of the United States consuls in all parts of the world. The reports are afterward issued in monthly parts for permanent reference; but the daily publication, coming as nearly as possible to the date of writing the report in the foreign city, is of great value to American manufacturers and exporters. The "daily" idea is a comparatively recent stroke of enterprise on the part of the government, and it is greatly appreciated. The faithful consuls, too, who, as a class, are conscientiously endeavoring to advance the trade interests of their country abroad, must be pleased that the results of their work—or some of the results, at any rate—are spread promptly before the public at home. It would be difficult to name any agency doing more for the extension of American export trade than the "Advance Sheets of Consular Reports."

A telephone transmitter that is one thousand times as sensitive as those in ordinary use is a pretty sensitive affair, and yet that is what some of the newspapers say that Thomas A. Edison, Jr., says he uses in experiments that are to lead to transatlantic telephony by the use of submarine cables. Perhaps in the repetitions of the statement there has been some mistake, and the new transmitter is really only 950 times as sensitive as the ordinary one; still it would be a very fine instrument and well worth the attention of the Bell company if it fails to uphold the Berliner patent. Young Mr. Edison also uses "powerful induction coils," it is reported, and is credited with the intention of talking from New York to London. Arrangements are being made, it is said, for a test over the Haytien Cable company's wires about the end of December. If talking through submarine cables such as we now have can be accomplished for long distances, it will be a great achievement indeed. But it seems an almost hopeless task, and we believe that Mr. Edison, Jr.—always assuming that he has been correctly reported—can take a leaf from his father's book in this branch of telephone practice to great advantage.

After years of experiment, the submarine boat has reached a stage of development where it has secured the approval of American naval officers. The report of the Board of Inspection and Survey on the recent official test of the Holland in Peconic Bay has been made public by the secretary of the navy. The board reports that after a thorough inspection of the plans and of the vessel it was impressed with the excellent condition of the boat and all its appliances. All the requirements of the department were fulfilled by the performance of the Holland on this trial. Captain John Lowe, a member of the board, says that a submarine-boat service should be at once organized as a matter of public necessity and security to protect the coast cities against the possible attacks of foreign fleets. Of course, the boats are propelled by electric motors operated by storage batteries when under water, and if they should come into general use they will add to some extent to the requirement for these classes of apparatus, already in special demand for automobiles.

It will soon be time for the selection of the official delegates to represent the various nations of the world at the electrical congress to be held in Paris next August in connection with the exposition. In the United States this pleasant duty may fall to the American Institute of Electrical Engineers, unless the authorities in charge of the affair should request that the official representatives be appointed by government. In either case there is little doubt that men of high standing and recognized technical ability will be selected. At the World's Electrical Congress in 1893 in Chicago, under the honorary chairmanship of that distinguished scientist, Dr. von Helmholtz, since deceased, there was a notable gathering of electrical men. The chairman of the Chamber of Delegates was H. A. Rowland, and the other American delegates were Elihu Thomson, H. S. Carhart, E. L. Nichols and T. C. Mendenhall. Foreign delegates were Messrs. Preece, Ayrton, S. P. Thompson and Alexander Siemens of England; Mascart, Hospitalier, Violle and de la Touanne of France; Drs. von Helmholtz and Lumner of Germany; A. Palaz and M. Thury of Switzerland; Prof. Galileo Ferraris (who has since died) of Italy, and A. M. Chavez of Mexico. It is pleasant to note that M. Mascart is the chairman of the committee of French electrical scientists and engineers that has issued the call for the congress of next year, and that M. Violle is also a member of the committee. Other French electricians in charge of the arrangements for the coming assemblage are MM. Moissan, Fontaine, Gariel, Paul Janet, E. Sartieux, d'Arsonval, Joubert, Blondel and Lippman.

In its circular the French committee alludes to the great benefit of former congresses in stating and formulating units and terminology by international agreement. It then speaks more specifically of the scope of next year's meeting to the following effect: "During the last 20 years discoveries and applications the most unforeseen have arisen, which it might have been supposed would find their place only in the domain of pure science, and in fact this period has been marked by the great extension of the electrical industry. Thus, the practical side of the question has brought to light a great number of problems upon which it will be interesting and profitable to exchange our views. It seems important that, without diminishing the importance of the theoretical side of the question, the discussions of the congress should have above all a character more or less economic and industrial. It is with this end in view that the program which has been established indicates in a provisory manner the method by which the work is to be distributed among the different sections of the congress." As has been previously stated in the Western Electrician, the work before the congress has been divided into five sections: (1) Scientific methods and measuring apparatus; (2) Production of electrical energy, transformers, transmission and distribution, electric lighting, traction; (3) Electrochemistry, electrometallurgy, accumulators, electric furnaces; (4) Telegraphy, telephony and diverse applications; (5) Electro-physiology.

There is every probability that the Paris Congress of 1900 will result in a healthful interchange of views and spreading of intelligence, as its predecessors have done. In no other department of human activity, unless in the study and practice of medicine, are the specialists of the leading nations so well informed of one another's doings as in the applications of electricity, and this desired result is to be attributed to the several international electrical congresses as well as to the vigilance of the technical press. The American electrical fraternity will wish the forthcoming congress the greatest measure of success, and no doubt a considerable proportion of its number will do their best to achieve such a result by attendance and participation.

Train Service and Its Practical Application.[1]

By Ira A. McCormack.

It is an unquestioned fact that a well-arranged train service is as essential to the commercial success of a street-railway enterprise as is expert management of the power house and equipments, the use of economical machinery or any other vital detail, and it is perhaps one of the hardest problems that street-railway managers have been called upon to solve.

In presenting this paper the writer would not wish to be understood by the members as presenting a sovereign solution, but rather as submitting methods which he has found to be useful in cases that have come under his observation. The conceded fact that all discussions must have a nucleus and that the experience of no two persons are alike, whereby the natural law obtains, that one is certain to learn something from another, must be the apology for what follows.

In mapping out the train service of street-railway systems in a large city the problem will be found very intricate. Some lines have continuous traffic at almost uniform proportions at all hours of the day; some have rush hours at morning or night, or both; some have hours of overcrowding at more frequent intervals, and with some the traffic is exceedingly irregular. There is the passenger who rides but a few blocks; there is the through passenger and the transfer passenger. The problem is further complicated by the location of parks, places of amusement, shopping or residential districts, branch lines, and the summer and winter seasons, and it is perfectly evident that no general methods can be laid down.

The problem naturally divides itself into two parts—first, the ascertaining of the conditions of traffic which are to be met, and second, the means for meeting these conditions in the best possible manner.

No matter what the character of the service may be, suburban, excursion or local, there is one ideal condition to be aimed at, and that is that each car be full of passengers. If there be less than a full car the equipment is not run to best advantage and fewer car-miles would render the same service; while if the car is crowded, the traffic of those who dislike a crowded car may be lost and the management is likely to be criticised unfavorably by the public and press. It is important, therefore, to determine with as much accuracy as possible the traffic conditions; that is to say, how many of the public want to ride, where they want to ride, where they wish to take the car and where they wish to leave it.

For convenience in making specific illustrations and also to enable the discussion of different conditions as far as possible, the following different characters of service may be cited:

Line A. A line of heavy traffic in shopping districts in close competition with elevated railroads.

Line B. Doing a heavy traffic in residential districts without competition.

Line C. A cross-town line serving as a transfer system to connect other lines together and add to their attractiveness.

Line D. A cross-town line connecting with centers of transportation, such as railway stations, ferries and the like.

Line E. An excursion line, half of which is residential, on which the excursion traffic varies with the season.

Line F. A suburban line of considerable length and operated at moderately high speeds.

Line G. A line not over-remunerative and operated for such reasons as public or press opinion or hope of its future value.

The conditions that will obtain on these various lines are obviously widely different. At first it will be necessary to evolve a method of determining what these various conditions are.

At the start the manager is as helpless as an outsider. He can merely generalize and deduce a timetable which to his best knowledge of the system will fit the conditions, but having thus formed an existing timetable, the knowledge of how it operates and how it can be corrected is rapidly and easily acquired by the best of all methods, that of practical experience. In collecting the necessary data, a method which the writer has found of value is to provide each car conductor with a blank which contains spaces on which the number of passengers carried on the car between the termini can be conveniently listed and totalized. This slip is conveniently arranged, so that on it are registered the following data:

1. Name of operating line.
2. Run number as per timetable.
3. The date.
4. The time due to leave terminal.
5. The actual time of leaving terminal.
6. Passengers carried on down trip.
7. Passengers carried on up trip.
8. Totals.

This slip, signed by the conductor, is turned into the proper office. This, of course, gives general information as to the traffic. It shows whether it is heavy or light, whether it is falling off or increasing, whether it is increasing on the down or up trip, and also gives a check on the register. This information is usually collected in one way or another by almost every street-railway management.

The records are duly tabulated on a printed blank and daily compared, and if it is found that the traffic is increasing it may be wise to put more cars on the route, and if the traffic is diminishing a longer headway might be good policy. The next thing to determine is how these changes had best be made, and if possible, to ascertain the specific reason for the increase or loss in traffic. To do this the inspectors are provided with blanks and are sent out on the line. Various points are chosen, and at those points the passenger record is very carefully taken. This slip provides for the record of the following data:

1. The place of record
2. The name of the line.
3. The date.
4. The observed headway.
5. The number of passengers on the cars at points of record.
6. The figures rung up on the register at record points.
7. The totals.
8. The general average of these quantities.

On the back of the slip the inspectors find the following instructions and queries to be answered:

Note. Inspectors will be careful to show correct count. Make report plain and clear, but use as few sheets as possible.

If record of but one line is being taken, show the name at top of page.

If record of several lines is being taken, indicate name of each line in blank space at head of column.

If conductors are found short, give conductor's badge number and state particulars.

Give any and all information of this report that will prove of value in permitting change of headway and condition of cars, etc., to improve the service.

Is the headway well maintained?

Is there enough or too much service at any hour?

Are cars running to proper terminals to accommodate the public?

General condition of cars.

Conductor found short.

Car No. Conductor No. Particulars.

It is sometimes instructive to plot the results in the form of curves. Suitable section paper is selected and the number of passengers per hour are plotted as abscissæ and the hour of the day as ordinates. This gives opportunity to examine a large number of figures at a glance and is sometimes useful in drawing general conclusions.

These reports give much valuable information. They show the average number of passengers on the cars at the point of record, thereby determining whether the cars are overcrowded or not. It gives the total number of passengers carried up to the point of record and an approximate idea of where they left the car. If the traffic on the line is irregular, it shows in a measure where it is heavy and where it is light, according to how near together the points of observation are selected, and it further shows the exact time at which these traffic conditions obtain.

In order to obtain trustworthy results it will be necessary to take these records for some time, possibly for a week, for a single record might be completely misleading, because of condition of weather or a yearly Sunday-school picnic, or similar flush of traffic not likely to be repeated. It remains to be said, however, that as a rule weekly records check very closely.

Having obtained a fair average of the number of passengers to be carried between two points, the proper headway between these points can be computed, and the next question that obtains is how to get this headway.

It may be advisable to actually put on more cars, or, again, it may be that the increased traffic occurs between such points on the line when it would be advisable, if possible, to loop down upon this section a few more cars from some adjacent line, and more especially would this be desirable if at the corresponding section on the adjacent line the headway was found to be too short.

So far the method seems to be a simple mechanical process in which the steps for remedy are as obvious as in a station test. It is unfortunate for the sake of simplicity that this is not the case. In making a station test the diagrams and curves obtained invariably show the condition of the machinery or apparatus tested. The curve traffic above described would show the condition of traffic, were it not for the fact that the public and many local conditions, which would seriously affect the traffic, must be considered. As an instance of this, when the information is being gathered to plot out the curve traffic, a fair, festival or entertainment of some nature may be in progress, which would cause traffic to go in the direction of the entertainment. Therefore, the curve traffic, without considering the local and all traffic conditions, might lead to an erroneous conclusion. The maker of a new timetable must know the lines, root and branch. There are certain rules which long experience has shown are almost inviolate. There are certain traffic conditions which are temporary and others which are permanent. There are competition conditions, and in many ways there is much else besides these records to consider.

For instance, those who travel on street cars I have classified as follows:

1. The workers, who travel from five to seven.
2. The clerkers, who travel from seven to eight.
3. The bankers, brokers and proprietors, who have been sometimes facetiously termed the "shirkers," who travel from nine to 10:30.
4. The shoppers, who travel from 10 to 12.

The greater part of these people remain in the city, coming back in one grand rush hour, which begins between four and five and reaches its culmination point a little after six, and sometimes lasts until after seven. Then the theater and places of amusement begin to influence the traffic, which swells in the direction of the metropolis till a little after eight, and outward again from 10 to 12. The regular night-hawks, who take care of the traffic of the city between 12 and the early hours of the morning, it is usually wise never to disturb.

It is sometimes possible to meet the traffic conditions on a line without increasing the car mileage by simply changing the character of the cars which are running upon the line. Long cars with double trucks are advisable on through traffic, and it should be aimed to run at such times when they will collect through passengers. Short cars should be run for the convenience of short riders, and if it be found on any line that at a certain hour of the day a large percentage of short riders take the cars between certain points, a little ingenuity in adjusting the long and short-car service may frequently accomplish a great deal.

On Sundays and holidays the traffic conditions change radically. On some lines the traffic falls off a great deal and on others it becomes exceedingly heavy. On lines running to places of outdoor amusement, such as parks, beaches, racetracks and the like, it is well to watch the weather, for it is obvious that if the day is pleasant the traffic will be much heavier than otherwise.

The best men are picked out to run on the strange lines and on lines of heaviest traffic, in order to have the benefit of their experience in handling the public, knowing that they will be more safely handled and more convenient service given them than if a poor class of motormen and conductors are operating the lines of heaviest traffic. A street-railway manager would—were it in his power—locate amusements and entertainments upon the best-built and best-equipped lines, for it is on these lines that the best service to the public is given.

Of the last statement, it may well be said that the duty of a superintendent may be divided into two equally important portions: First, the arrangement of the system for the good of the company and public, and second, for the good of the men. These duties are not all incompatible, although by some this has been thought to be the case. It is very important for the company to have a force of competent, well satisfied and not overworked men. I contend that a man earning $40 a month, and who is satisfied with his surroundings and conditions, is a better employe for any company or corporation than a man who is earning $500 a month, and who is discontented and dissatisfied with the surroundings, and, on the other hand, it is important for the men that the company shall be prosperous, for otherwise there will be less regulars and more trippers.

It frequently happens that the timetable of a road can be corrected to meet the conditions of traffic by delaying the cars at certain points and increasing their speed at others; thus, for instance, it has often been found beneficial to instruct the motormen to stop their cars at junction points and wait for the car on the cross-road in order to exchange transfer passengers, or perhaps to wait a stated time, say two minutes, and then to proceed. It is plainly to the advantage of the road to exhaust all such devices as this before actually running more cars to meet the increased conditions of traffic. If more cars are actually to be run, the question should then be considered as to what kind of cars; that is to say, long cars or short cars; and if the road be a main artery, receiving the traffic of several branches, or cross-lines, whether these cars should be main-line or branch cars, and if branch cars, which branch.

From a practical knowledge of the conditions and from the data as has been outlined, a new timetable can be made up, but it is not to be expected that it will prove of lasting value. The traffic must be carefully watched, the conductors' reports carefully compared, and whenever an increase or decrease of traffic is shown, the advisability of sending out inspectors with passenger-record slips should be at once considered.

Those conditions show the necessity of an intimate knowledge of the entire system. The management, however, should not deceive itself in case mere adjustment is not successful. If the cars are still crowded, in spite of all manipulation of length of car and variation of headway, more cars should be put on.

However instructive it may be to make general remarks on these matters, specific cases and their solution are always interesting, and to provide this the writer has selected from his records a number of cases illustrative of different conditions, which may be of interest to the members.

A practical condition that obtained recently was the case of a line (H), which formerly had its route down another line (J) to a ferry terminus. The inspector's report showed, first, that it was needed to increase the service on a certain intersecting line (B), and, second, that a great many passengers from line (H) transferred to line (B); in fact, more than continued down line (J). When these facts were known the solution was obvious. The traffic of line (G) was cut off altogether from line (J) and sent down line (B), thereby giving the desired service, avoiding the transfers, and only very slightly increasing the mileage, and not at all in-

[*Continued on page 316.*]

[1] Read before the American Street Railway association at Chicago, October 19, 1899.

DEVELOPMENT OF THE TELEPHONE FIELD.

Central-energy Systems.

By A. E. Dobbs.

By central-energy telephone systems proper are meant those systems in which all batteries, both for signaling and speaking, are located in the central office. At the risk of being thought an enemy to progress—which he is not—the writer intends to show that such systems are not an unqualified success and that for exchanges giving a good service with present equipment it would be better to proceed slowly until these new systems have been more fully proved. The money paid for first-class instruments of the old type, metallic circuits, multiple switchboards and well-built pole lines will, it is here contended, produce more satisfactory results than any central-energy system. Let us suppose, for instance, that two exchanges are competing for business in one town, one having a central-energy system with first-class equipment, the other having first-class instruments with local batteries, local generators and metallic circuits. With good management the latter will give the better service.

The advantages claimed for central-battery systems are:

First—Low cost of instruments, as the instrument contains neither battery nor generator.

Second—Great saving and higher efficiency in batteries, as the batteries are located in the central office, where they are under constant inspection and can be worked to their fullest extent.

Third—Saving in the cost of inspection, as fully two-thirds of the instrument troubles come from the batteries. Therefore, with no local batteries, the telephones will rarely need inspection.

Now, all this is very attractive—on paper; but some telephone men are not satisfied; and actual experience and observation of the systems now being installed in even small exchanges by licensees of the Bell company, and by some Independents as well, tend to confirm their doubts.

As to the first claim: We save the cost of the generators and batteries in the instrument, making a difference in the first cost of possibly $3.50. But this is not all saved, for the ringer coils must be wound to a higher resistance, running from 1,500 to 2,500 ohms, to say nothing of choke coils and condensers, which, at the most liberal allowance, will make the net saving not to exceed $2. As against this $2 saved on the first cost of each instrument, we will have at least $500 tied up in motor-dynamos with their accessories for charging the storage batteries necessary in a system of this kind, without taking into account the charge for current, etc., in comparison with which salammoniac becomes pretty cheap.

Nor does the expense end here. Assuming that metallic circuits are used—though that need not necessarily be the case—nothing but the best of cables and highest and most expensive grade of insulation will stand a constant battery pressure of from 25 to 50 volts continually present on the lines. With the local-battery instruments, iron wire—in many cases run through trees, attached to porcelain knobs and even connected to instruments by the much-despised annunciator wire—will give good results with very little appreciable loss of current. This is so because the line is practically "dead" except while in actual use, especially if the line is a metallic or common-return system. Light aerial cables, wound with a single paper tape and having an insulation of perhaps 10 megohms (which is very low for a cable of this kind, most specifications requiring a factory test of 500 megohms per mile), will give good talking service. But put a continuous battery into such a cable, leave it there day after day and month after month, and the insulation will deteriorate under the stress of a current always on the lookout for a weak spot, to say nothing of electrolytic action in a terminal where there might be a slight amount of dampness, which, in ordinary systems, would not be noticed. Trees must also be carefully cut away or avoided, and those who have had much experience in line building and tree trimming know what this means.

Beside the best of insulation, copper wire becomes necessary, which, at the present price of copper, is about five times as expensive as iron or steel. If the cable system is so well distributed that the average amount of wire from the terminal to each subscriber equals one-third of a mile, this difference would mean a greater cost of $4 for each subscriber, or double the saving on the first cost of the instruments. But even the first cost on the instruments is not saved, for the men who hold patents on these systems want a royalty, and it will be found that the selling price is just as high as, if not higher than, that of first-class instruments of the ordinary kind.

Copper wire is a good conductor, of course, but in lines of the length previously mentioned there is no perceptible difference between copper and the ordinary steel wire. In central-battery systems, however, copper is necessary, in order to deliver the proper amount of battery current to the transmitter. Even then the long lines are apt to get less than the short ones, though this may be equalized by measuring the resistance of the longer lines and inserting an artificial resistance sufficient to equalize them all. Thus, if line No. 24 has a resistance of 100 ohms, while No. 124 has only 20 ohms, a resistance of 80 ohms inserted in line No. 124 will make them both equal. As no two lines would measure alike, all these artificial resistances would have to be made on the spot.

As to the second claim, regarding cheapness and efficiency of battery, the first item has already been disposed of. Those who have handled storage batteries know that they are neither cheap as to first cost nor inexpensive to maintain, while a good salammoniac battery does not need attention oftener than about once a year, and all instruments should have a general inspection at least as often as that, central-energy or otherwise.

The third claim—saving in cost of inspection—is not borne out by experience, for central-energy systems develop aggravating troubles peculiarly their own, and so far as anyone can see they keep fully as many men around as the old-fashioned systems. With the isolated telephone a cross or ground will not necessarily cut the subscriber off from the office, for in many cases he can still get a sort of service—a very poor sort, it's true, but still good enough to use until the trouble can be cleared. With central-energy systems a cross or ground will throw the drop down, and it will stay down until someone can go out and clear it, but in the meantime the subscriber is completely cut off. In case there is a storm in the night, enough drops might come down to run the battery down before morning, as the larger part of the battery will follow the line of least resistance, and there might be drain enough to prevent anyone else from calling in. Such cases have happened.

To be sure, the falling of the drop is an instant notice of trouble on the line, but experience shows that trouble men will not hustle any faster after a fallen drop than they will after an operator's report. It is also pretty well understood by this time that, owing to choke coils, condensers, etc., in the circuit, conversation is not as strong or distinct as in the local-battery systems, besides the increased retardation in the cables. For example: A circuit passing through a cable in which are a hundred other circuits will encounter a retardation, due to capacity and other induction, brought about by the close proximity of the other circuits. Now put on a battery pressure of 20 or more volts on everyone of these neighboring circuits and the retarding effect is greatly increased; so much so, that even the much-despised Blake transmitter with local batteries will talk almost as far as the granular-carbon transmitter, with central battery, on long-distance work.

There is one other claim sometimes made for the central-battery system—that it is quicker in operation. Now there are three things the operator has to do in any system: First, plug in and get the desired number; second, insert the companion plug into the called number; third, ring the called subscriber. With a trunking system between sections, from three to five seconds more are required for the last operation, but this can be eliminated by means of a multiple board, while a central-energy system might possibly save half a second in the "busy" test. All the rest depends upon the operator. On the common switchboards, scattered over the country, some are a second or two faster in operation than others. Can a central-energy system be any faster than the best of these? Thousands of patrons where central systems have been installed have not found it so. As has been said before, more depends on the operator than on the system in use.

One advantage of central-battery systems should, indeed, be mentioned. While many subscribers under the old system will not ring off, it is to be noted that under the new plan hanging up the receiver is a positive notice to the operator that subscribers have finished talking.

A first-class local-battery instrument is simple, easy to install, easy to maintain, requires no expensive construction nor complicated switchboard work, no choke coils or condensers; will work under almost any conditions and requires little attention. Each pair of lines connected constitutes a self-contained isolated unit, not disturbed by troubles on any other circuit. Finally, the local-battery telephone will give better talking service.

The writer does not wish to take the ground that the objections he has mentioned cannot be overcome, but to suggest some of the difficulties that must be met. Many bright inventors are trying to work out these problems, and it is to be hoped that they will succeed. To our inventors in the Independent field it might be said that to succeed they must devise a system "better than the Bell."

Familiar Tactics in Maryland.

A dispatch from Frederick, Md., states that the Frederick County Telephone company, composed entirely of local capitalists, had practically driven the Chesapeake and Potomac company out of the field by reducing the prices from $50 and $35 to $25 and $15 for business and residence telephones, respectively. Recently, however, the old company has installed 125 telephones, and as quick as it can get its lines in operation will give service free of charge for 90 days, and then, it is said, will reduce the rates to $24 and $18 a year.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The telephone companies at Winona, Minn., want an ordinance passed requiring house movers to reimburse the companies for the removal of wires and poles.

The Nelsonville Telephone company is extending a line from Nelsonville, Wis., to Rosholt.

The Rushford (Minn.) Telephone company has been granted a franchise for a local exchange at Rushford.

The completion of the American Telephone and Telegraph company's lines to West Superior, Wis., has aroused the people of Duluth and they want long-distance connection too. The American company professes to be very solicitous to give the desired connection, but is unable to do so because the council of Duluth will not grant the franchise asked. The new Zenith Telephone company of Duluth announces that by January 1st, if the American Telephone and Telegraph company so desires, it can give the people of Duluth long-distance service through its exchange. It offers to pay such rates as the company receives elsewhere, or will arbitrate the matter of charges.

The Northwestern Telephone Exchange company is completing a large amount of new work. Among the extensions is a new line from Grafton, N. D., to Pembina and St. Vincent; from Crookston, Minn., to Fosston; From Park River, N. D., to Langdon; from Grafton, N. D., to Cavalier; from Casselton, N. D., to Hunter; from Fargo, N. D., to Barnesville, Minn.; from Wadena, Minn., to Fergus Falls, Minn.; from Crookston, Minn., to Thief River Falls. These will about complete the season's work. There is still being constructed additional circuits and rebuilding lines from Fargo, N. D., to Grand Forks; Brainerd, Minn., to Fargo, N. D.; Minneapolis to Mankato; Mankato to Worthington; Minneapolis to Albert Lea; St. Paul to Owatonna; St. Paul to Red Wing; St. Paul through to Winona; Austin, Minn., to Albert Lea; Albert Lea, Minn., to Fairmont; Minneapolis to St. Cloud, and a number of other short lines. The construction is all-metallic circuit and all-copper work. The company has just cut over to a new board and system for the St. Paul exchange. Taking all the lines built and the St. Paul system rebuilt, the company has expended close to $400,000 for the season. Plans are not formulated for next year, except in a very general way. There will be considerable toll-line extensions in North Dakota in 1900, some small lines in South Dakota and nothing especial in Minnesota. A line may be extended from Fosston, Minn., to Duluth; from Crookston, Minn., to St. Vincent; Jamestown, N. D., to Lisbon, via Oakes and La Moure, and possibly west from Jamestown toward Bismarck.

Complaint is made in Minneapolis that "busy" is returned when lines are called for on the Northwestern Telephone Exchange company's system, when investigation proves the lines were not busy.

Gleason & Sleight sued the Wisconsin Telephone company at Ashland, Wis., for $300 damages for poor and inefficient telephone service in the city. The jury awarded a verdict of $100.

The Cannon Valley Telephone company will extend a toll line from Cannon Falls, Minn., through Wastedo.

The Northern Minnesota Telephone company has been granted a franchise for a local exchange at Park Rapids, Minn.

The Badger Telephone company, which owns and operates an exchange in Waupaca, Wis., with 25 miles of toll line, has changed hands. The new owners will reorganize as the Citizens' Telephone company and begin aggressive operations in Waupaca and Waushara counties against the Bell interests. Connection will be made with the Wolf River company's lines.

The La Crosse (Wis.) Telephone company announces that it will not sell out to the Bell interests, although it claims to have received several propositions to do so.

The Minnesota Mutual Telephone company has completed a toll line from Morris, Minn., to Breckenridge, Minn.

The Nevada County Telephone company and the Boone County Telephone company were both applicants for a franchise to put in a system at Ames, Ia. The officers got together and arrived at an agreement by which the Boone company should put in the system.

A telephone toll line will be extended from Fort Madison, Ia., to Farmington and intervening points.

Residents of Albion, Ia., and farmers between Albion and Marshalltown have perfected arrangements for the construction of a telephone line between these points, with connections on all farms passed.

C. V. Kathrens of Kansas City, Mo., representing Kansas City capitalists, has been in Davenport, Ia., and Rock Island and Moline, Ill., interviewing business men with a view to establishing a telephone system covering the three towns.

The Custer County Telephone company has been formed at Miles City, Mont., to connect with the towns of the county. The capital stock is $10,000.

W. W. Epps has resigned as manager of the

Ottumwa Telephone company of Ottumwa, Ia., and is succeeded by W. P. Hardy of Cleveland, O.

The Standard Telephone company has begun constructing a system in Dubuque, Ia.

The Kossuth Telephone company has extended its toll lines to Swea City, Ia. Simultaneously the Western Electric Telephone company announces free service over its lines from Bancroft, Ia., and vicinity to Swea City.

The county commissioners of Hennepin County will install a telephone system, covering the courthouse in Minneapolis, to connect with every office in the building.

The mayor of St. Paul has approved of an extension of time for the Mississippi Valley Telephone company to get its new system in operation.

The Wisconsin Telephone company has purchased a site in Eau Claire, Wis., and will erect a fireproof exchange and office building, to cost $20,000.

The telephone line from May, Wis., to Shell Lake, Wis., is for sale.

C. E. Thew has been succeeded as superintendent of the telephone exchange at Menomonie, Wis., by F. F. Morris, formerly manager of the Chippewa Falls exchange. Mr. Thew will go to Iowa City, Ia., where he will be in charge of the new exchange.

The Rock County Telephone company will expend $5,000 in improvements to its system at Janesville, Wis.

The Midland Telephone company of Adrian, Minn., is extending its lines to Rock Rapids, Ia., to connect with the Iowa and Nebraska Telephone company there.

Situation in Logansport.

In Logansport, Ind., where there has been some talk of municipal ownership of the Mutual telephone plant, to prevent the system from passing into the hands of the Bell people, the matter seems to be still unsettled. The Central Union company (Bell) is credited with the intention of absorbing its competitor in Logansport, if possible, and some persons assert that it has already secured control. On the other hand, the New Long-distance Telephone company (Independent) of Indianapolis, in which Mr. S. P. Sheerin is interested, has applied for a franchise at Logansport and has, furthermore, agreed to connect with any Independent telephone plant in that city or with a municipal plant. Mr. Sheerin says that the New Long-distance company is making rapid progress with its toll line to the northern central part of Indiana. It is now building between Marion and Kokomo, and Logansport will be the next city it will reach.

Ashtabula Is All Right.

The directors of the Ashtabula (O.) Telephone company held their semi-annual meeting last month and received the report of Secretary Crosby, including the financial statement, which was very gratifying, as it showed the net earnings for the last six months to amount to nearly $2,000. The company at present has 490 telephones in service, with orders booked for 39 to be put in as soon as possible, and more orders to be secured as soon as necessary extensions can be made. The directors authorized the stringing of another set of wires between Ashtabula and Conneaut, the present lines being inadequate to accommodate the business between these growing cities. The sale of $5,000 additional stock was authorized as needed for additions and extensions and a semi-annual dividend of four per cent. was declared.

EXTENSIONS AND IMPROVEMENTS.

Telephone wires in the main streets of Waco, Tex., are to be placed underground.

L. D. Brannon of Commerce, Tex., is establishing a telephone exchange at Wills Point, Texas.

The Lyons (Kan.) Telephone Exchange has 102 subscribers and toll-line connection with 38 towns. The exchange is extending its toll line from Chase to Great Bend, Kan.

The Rocky Mountain Bell Telephone company expects to expend some $200,000 in establishing its Salt Lake-Denver connections, thus joining the Utah and Wyoming systems.

J. W. Hunter of Chattanooga, Tenn., secretary of the East Tennessee Telephone company, has received a franchise for the construction of a telephone system at Barboursville, Ky.

The Boyle Citizens' Telephone company of Danville, Ky., has about 24 miles of telephone line now in operation, and will extend its system over seven or eight counties. C. R. McDowell, Danville, Ky., is interested.

The Mutual Telephone company of Huntington, W. Va., proposes to expend $50,000 in improvements, which will include new and larger poles, copper wire, new switchboards and new telephone boxes with long-distance transmitters.

The Nassau County (N. Y.) Board of Supervisors has granted to the South Shore Telephone company a franchise for the extension of its local telephone service through the county. The company is endeavoring to establish an Independent telephone service on Long Island.

Privacy of Telephone Communications.

By H. P. Clausen.

Part IV.

In a preceding section of this series of articles the presence of an eavesdropper on a telephone circuit was definitely determined by the aid of a deflecting-needle galvanometer and battery, connected in series with the telephone instrument. In the present paper we may consider an intercommunicating section with the eavesdropper's equipment bridged between the line wire and earth return, as shown by (T″) in Fig. 8. For the purpose of our discussion, let it be taken for granted that the existence of an eavesdropper is known, but that his equipment cannot be located and that it then becomes necessary to devise some means by which the (T″) telephone may be rendered inoperative in response to voice-current waves sent from and to the (T) or (T′) telephone stations.

Referring to Fig. 9, a method is illustrated which in most instances can be made to give excellent satisfaction. As will be observed, the (T) and (T′)

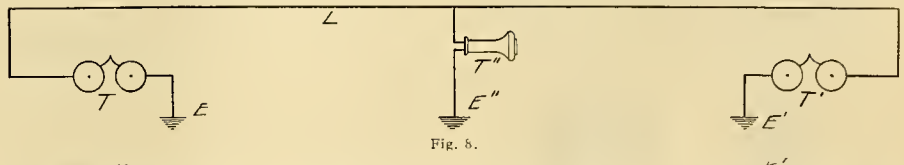


Fig. 8.

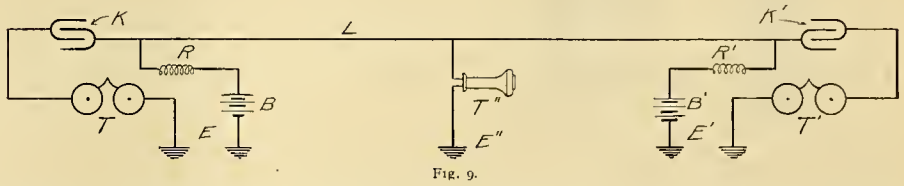


Fig. 9.

PRIVACY OF TELEPHONE COMMUNICATIONS.

telephone-station equipments are connected one side to earth and the remaining side to the line wire (L), through the condensers (K K′), while the line wire itself is connected with the return circuit by the retardation coils (R R′) and batteries (B B′). With the above connections it is quite apparent that normally the (T″) receiver-magnet coils are giving passage to a current which is of a sufficient strength for attracting its diaphragm and holding it fast to the pole-pieces, thereby preventing it from responding to the voice-current waves passing between the (T) and (T′) terminal stations. Thus, it will readily be understood that any conversation passing between (T) and (T′) cannot be understood by an eavesdropper at (T″), by reason of the bound diaphragm in the (T″) telephone.

As it is well understood, the retardation coils (K K′) may be of a comparatively low resistance and still offer a very high apparent resistance to the rapidly vibrating voice currents, while the condensers present no particular bar to their passage. Inasmuch, however, as the condensers will prevent any battery current of the batteries (BB′) from passing through the (T) and (T′) telephones, it is obvious that while the (T″) receiver is rendered ineffective, the (T) and (T′) receivers are in no way affected.

Activity in West Virginia.

The West Virginia Western Telephone company has just opened in Parkersburg, W. Va., what is said to be the largest Independent exchange in West Virginia. An advance directory of subscribers in that city, of whom there are said to be about 400, is promised for December 1st. The company has a modern, well-built plant, with full-copper circuits, long-distance instruments, up-to-date switchboard and excellent underground and overhead construction, and it purposes to give Parkersburg and the contiguous territory the best telephone service it has ever had. Prices are $24 a year for business telephones and $18 for residence instruments. The company says that it now owns and operates over 1,000 miles of toll-line wires, and through the West Virginia Central Telephone association has connection with several thousand miles of toll-line wires, giving service in West Virginia and in a few counties in western Pennsylvania and Maryland. The company has also in contemplation the construction of several hundred miles of toll lines within a radius of 100 miles of Parkersburg, enabling the community in that territory to have close association with the city. The officers of the company are: President, C. E. Haddox, Cairo; vice-president, Levin Smith, Parkersburg; general manager, J. H. Grogg, Parkersburg; treasurer, R. H. Rutherford, Petroleum; secretary, J. H. Lininger, Harrisville; office manager, A. C. Davis.

Michigan Company's Hard Luck.

The City Council of Kalamazoo passed an ordinance requiring telephone companies to put their wires underground. The Michigan Telephone company had put in two miles of conduits when the mayor vetoed the ordinance. The council sustained the veto, and now the telephone company has apparently spent several thousand dollars without necessity.

Telephone, Telegraph and Cable Company of America.

Mr. William C. Whitney, according to a recent New York dispatch, says that he is not connected with the new Telephone, Telegraph and Cable company and has not been at any time. However, he disclaims any opposition to the new company, but says that he is not now engaging in new enterprises.

It is said that the full board of directors of the new company has not been chosen, but that the following-named gentlemen will serve: John Jacob Astor, Thomas Dolan, William L. Elkins, Charles R. Flint, Francis M. Jenks, W. H. Geishenen, Martin Maloney, Emerson McMillin, Frank Tilford, P. A. B. Widener, Charles E. Adams, Oakes Ames, Z. T. Holbrook of Boston, and W. H. Crocker of San Francisco.

It is said that the Telephone, Telegraph and Cable company has secured control of the new Massachusetts Telephone and Telegraph company of Boston, in which Mr. Holbrook is largely interested, and will operate in New England through this company. In New York the plans for the consolidation of the two anti-Bell companies—the Knickerbocker and the People's—are said to have fallen through. The Knickerbocker company, of which W. H. Eckert is president, is believed to be affiliated with the new Telephone, Telegraph and Cable company, while behind the People's company, of which Darwin R. James is president, are the members of the Board of Trade and Transportation. Both of the local New York companies are said to have secured the right to use subways for their wires. The contracts made by the People's company are said to be on a basis of about $100 a year for unlimited service, and the rate for 1,000 messages is said to be about $45. The Bell company's rates in New York are $240 for unlimited service and $75 for 500 messages.

A late statement is to the effect that interests identified with the new Telephone, Telegraph and Cable company have secured control of the Telephone Contracting company, which has a contract to enlarge the plant of the Hudson Telephone company in Jersey City, and that the latter corporation will soon be taken over by the Telephone, Telegraph and Cable company.

Danville Company's Bonds Withdrawn.

At a recent meeting of the stockholders of the Danville (Ill.) Telephone company it was decided to withdraw the unsold bonds of the company now in the hands of a trust company from the market. There are $50,000 worth of these bonds. Among those attending the meeting from out of the city were Frank Davis, A. M. Mills and A. J. Banta of Ridgefarm, David Hoover of Rossville, Dr. Holden and C. E. Schance of Sidell, H. L. Williams and A. J. Williams of Indianola. The company was shown to be in a prosperous condition.

MANUFACTURERS AND DEALERS.

The Central Electric company, Chicago, is issuing attractive and complete price-lists on telephone construction and wiring material. Any exchange which may have been overlooked in the distribution of these lists may receive copies by asking for them.

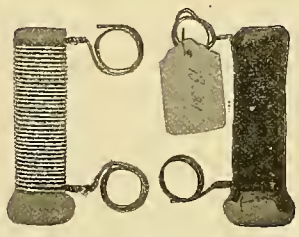
The Western Electrical Supply company of St. Louis now offers to the public its new 1900 telephone and its Western express switchboard. It believes that it has as high-grade apparatus as is on the market to-day, and will take pleasure in supplying a detailed report of its product to anyone desiring high-grade telephones and switchboards.

The Victor Telephone Manufacturing company requests the Western Electrician to state that it has no exclusive agents or general agents who are jobbers or assemblers of telephones, appliances or parts. "We are individually and entirely responsible," it says, "for the distinctive superiority and high quality of Victor products, their high efficiency, simplicity, fewness and strength of parts, perfect insulation, ease and rapidity of operation, durability and economy of maintenance. The jobbing house which stated that it controlled the output of our factory in certain territory was mistaken. It has no connection whatever with our output of our products in any section of the United States."

Ward Leonard Resistance Units.

The accompanying cuts will give an idea of a little specialty that has been brought out by the Ward Leonard Electric company of Bronxville, N. Y., that is particularly applicable where a cheap and easily manipulated resistance is required. These "resistance units" are of exceedingly simple construction, being nothing more than a pottery tube, around which the resistance wire is wound and afterward completely covered with a special enamel of superior qualities for this duty.

Those familiar with the difficulties encountered by the manufacture of enamel rheostats in producing an enamel with which to surround fine-wire resistance will appreciate the accomplishment of the Ward Leonard Electric company in having at last secured an enamel that would "give," so to speak, under the expansion and contraction of the



FIGS. 1 AND 2. WARD LEONARD RESISTANCE UNITS.

wire, thus preventing those tantalizing breaks where very fine wire is used, and yet remaining elastic enough not to crack under the expansive action of the heated wire.

These simple resistance units are wound in such a variety of sizes, from the highest resistance down, that a practically infinite variety of combinations in resistance can be secured by the simple coupling in series or parallel of the proper number of these little units. They are eminently suited for the variable service of the laboratory. Fig. 1 shows the tube just previous to the application of its covering of enamel, and Fig. 2 indicates the appearance of the tube ready for shipment.

Blow-out and Motor-suspension Patents.

Judge Edward B. Thomas of the United States Circuit Court for the Eastern District of New York (Brooklyn) rendered a decision on November 10th, at final hearing, in which he held that the magnetic-blow-out patent No. 283,167, dated August 14, 1883, and granted to Elihu Thomson, is invalid and void because not involving patentable subject-matter, and, therefore, the bill of complaint in the Thomson-Houston Electric company vs. the Nassau Electric Railroad company, based on that patent, was dismissed. This is the broad basic magnetic-blow-out patent that is so well known in the art, and which has caused much uncertainty to the outside companies. The Nassau Electric Railroad company was supported by the Lorain Steel company, whose apparatus it was sued for using.

On the same date Judge Thomas rendered an opinion respecting the Sprague motor-suspension patent, that has heretofore figured in litigation against the Walker company prior to its consolidation with the Westinghouse company. Judge Thomas construes claims 2 and 6 of the motor-suspension patent No. 324,892, differently from the construction heretofore given to that patent, and holds those claims to be good and valid and infringed. The name of this case is Sprague Electric Railway and Motor company versus Nassau Electric Railroad company, and it also was defended by the Lorain Steel company.

Pollak-Virag Tests between Buffalo and Chicago.

It is expected that the first tests of the Pollak-Virag automatic rapid-telegraph system will be made within a week. The proprietors of the Chicago Tribune are assisting in the tests, and the Chicago station will be in the Tribune building. The first test will be made over the Tribune's wire from Buffalo, the transmitting instrument being placed in that city and the receiving instrument in Chicago. Messrs. Pollak and Virag, who will conduct the tests, one being in charge at each end of the line, are confident of their ability to transmit from 80,000 to 100,000 words an hour. After the Buffalo-Chicago test, the transmitting instrument will probably be taken to New York, and a New York-Chicago wire will be used.

The Fort Wayne (Ind.) Traction company has been incorporated, with $2,000,000 capital stock, to operate electric lines in that city and on roads radiating from the city. The company is the successor of the Fort Wayne Consolidated Railway company and was incorporated by J. H. Bass, G. A. Garretson and H. P. McIntosh.

Train Service and Its Practical Application.

[*Continued from page 313.*]

creasing the number of trips of equipments.

Another interesting case may be cited of a line (I), a short line running from the terminus of a main artery upward into the country. The traffic was found to be so great that it was necessary to diminish the headway. This was done by running some of the main-artery cars over line (I). This had the effect of slightly increasing the car mileage, but it did not require any new equipments and gave through service from terminus of the main artery to the further terminus of line (I), which was beneficial.

Another interesting case is that of a cross-town line (C). This line carries through passengers to its terminus, and also acts as feeder to the various lines which it crosses; therefore in one portion of its length the traffic is exceedingly dense, and the headway must be correspondingly short. This object is simply attained by running short lines, which travel back and forth through the sections of heavy traffic, and the through service is run on a headway suited to fit the conditions of the more extended portion of the line, and also helps to diminish the headway in the more heavily patronized sections. Line (D)—the other character of cross-town line—is also very interesting. The line starts at a railroad terminal and distributes incoming passengers to their destinations. It passes through a large factory district and transfers a great many passengers to other lines crossing it at different intervals, also traverses shipping districts and gives access to the docks. It is essentially a day line, and it has been found that in such a case the traffic has been met to best advantage by a practically uniform service. This is a unique exception in railway work. As a final illustration, we may take a line (E) on which the traffic varies. The first section of the line is residential. The last is excursion. In the summer season the headway on the residential district has to be quite short to accommodate both classes of traffic. In the winter season the conditions are met by cutting the line in two and running a suitable headway through the residential district and a shuttle service of a few cars over the excursion section.

The street-railway manager will easily see that these methods are typical, but by no means exhaustive. There are many methods of manipulation, and the opportunity for ingenuity on the part of the maker of the timetable is exceptional.

Besides ascertaining the traffic conditions on the various lines, it will be found necessary to pay strict attention to the actual management of the system in order to obtain the train services that may be desirable.

In the first place, the power houses must be located at such points as to conduce to equal distributions of voltage. Low voltage on any line means slow time, no matter how good the motorman or the equipment, and everything that may produce this trouble should be carefully avoided. Every precaution must be taken in the operation of the power house to prevent shutting down. Power-house attendants often become careless and are slow in replacing a circuit-breaker when it is blown out, not realizing that they may be wasting the time of as many as 1,000 persons. The writer has known cases where the circuit-breakers of two different lines were thrown at one time. The man who watched only noticed one of them, and replacing that, failed to close the other, resulting in a most serious delay to the line which it supplied. It has been suggested that a switchboard should be equipped with an automatic device, which, in the event of a circuit-breaker being thrown, would close a circuit and cause the ringing of a large gong, which would show to the switchboard tender, or employes of the power station whose duty it is to see that the circuit-breakers are kept in, that there is some breaker or some line, which is not furnished with power. In this and in scores of other ways the station attendants are responsible for the accuracy of the train service in fitting it to an approved schedule.

There are also other cases which are incident to the power house which are in no way attributable to the men in direct charge. One of these which may be mentioned is the practice of false economy in purchasing poor quality of coal, which, in spite of all that can be done, allows the steam pressure to drop and does not supply the engines with sufficient energy. Similarly, the use of poor oil may allow important bearings to become heated, which results in crippling the line or overloading other machinery, thereby causing a reduction in voltage; or it may be that the headway for the time will have to be lengthened, thereby departing entirely from the approved schedule. In short, everything must be done at the power house to provide at all times sufficient current at a sustained voltage at the cars. Without this, any schedule, however accurate and elaborate, will fail in carrying out its object. The details of producing such service are so voluminous, and have been so ably discussed by other writers, that anything further than the statement of the condition would be superfluous here.

The track and overhead construction should be secure and serviceable. It is obvious that a good track is essential to good, comfortable riding, which will please patrons. Special work should be maintained in first-class shape and renewed promptly. It may be mentioned that it is not a wise practice to allow work of this nature to become worn to its last stages before steps are taken for its renewal. An order for special work of necessity cannot be filled promptly, and it may easily be that, if there is delay in placing the order, the old frogs and crossings will become very much worn, cars will be derailed, axles bent or broken, motors dropped, and, aside from the actual expense of repairs and maintenance, the train service, which is the prime factor, will be interrupted.

The writer's experience has been that considerable trouble has been encountered in maintaining a train service by reason of the spread of the rails and consequent accidents and delays. Where the traffic is at all heavy this accident is very liable to occur, unless the rails are bound with tie rods.

Like the track, the overhead construction should be of the very best. A broken trolley wire is even worse than a disabled track, for it may tie up not only one car but a whole section, and anything which will minimize the liability of wires coming down is advisable. In order to preserve the train service, the work of repairing the overhead construction should be performed at such times as will least interfere with the service. This is usually at night.

In order that overhead maintenance can be performed to the best advantage, emergency stations should be located, each of which is assigned to certain territories. The station covering the heaviest travel should be able to reach its outer boundary in eight minutes, while in suburban districts the farthest limits should be reached in from 15 to 20 minutes. The construction wagons should consist of an extension platform, from which the overhead work can be reached without standing the wagon in the track way.

Track and overhead-repair men should be impressed as strongly as possible with the fact that in making their repairs, it should be done in such manner and at such times as will least interfere with the operation of the cars. The judgment of some track and overhead-repair men cannot always be relied upon to carry out this injunction. Train service is often interrupted by track and line-men, in making repairs to the track and overhead system, by attempting to make too permanent repairs at a time when the service is heaviest and should be least interrupted, when a temporary repair would have done just as well, until such a time as the service was light and permanent repairs could be made without interruption to the service.

The writer knows of one particular case where the ear of a double pull-off on a curve had become so bent and out of its proper position, that when the trolley wheel was riding under it, the trolley would come off and one of the arms of the pull-off and the bent ear would serve as the prongs of a bootjack, the trolley harp and wheel catching in the arms of the pull-off and doing one of two things: Pulling down the overhead work or pulling the trolley pole from out of its base.

It is a common fault to pay too little attention to the application of guy wires on curves, and serious delays due to failure of overhead construction on curves are very frequent. Sometimes the work is satisfactory for short cars, but on long cars the motion of the trolley, being somewhat different, is likely to throw the wheel off the wire. Frogs should be placed in the overhead work where the lines diverge at a point that will insure the trolley wheels following the desired route.

Another and exceedingly important feature of good train service is the selection of motormen and their instructions in running the cars. Many elaborate papers have been written on how to run a car to use minimum current and to produce minimum wear and tear on the equipment. These instructions, while ingenious and accurate from a technical point of view, and possibly of wide application in small country roads, are not at all suited to the heavy traffic conditions which obtain in large cities.

In such cases the most important duty of the motorman is to make schedule time, keep a sharp lookout for passengers and avoid accidents. It is interesting to note in this connection that the best motormen are often men who can neither read nor write, and are found among teamsters, drivers of horse railways and the like. These men are accustomed to do implicitly as they are told. They are accustomed to watch the street carefully and keep good track of vehicles and persons, by which means they avoid accidents and secure passengers.

The semi-technical man who is "learning the business" makes the worst motorman of all. His mind is more active, he is interested in the performance of his motors and equipment and neglectful of his primary duties as motorman. He is always on the lookout to take note of matters which, though they may be valuable to him in his personal advancement, are entirely foreign to his duties. More than that, he is a dissatisfied individual, looking for better employment in the near future, and for that reason he is not inclined to learn his business of motorman thoroughly, regarding it as scarcely worth his while.

Of course, it is necessary that the motorman have certain instructions with regard to managing the controller. He should know that it is not advisable to give the motors too many notches at once; that he should, wherever possible, allow the motor to

gain speed on one notch before passing to the next; that he should run the car on certain notches as far as possible; that he should not allow the controller handle to dwell on spaces between notches; but it is not at all necessary for him to know why the motors are more economical at full series or full parallel or just what misconnections are likely to obtain if the controller is run between notches. It is sufficient that certain things must be done and that certain other things must not be done.

It is, nevertheless, a fact that a good motorman will run a car with less energy than a poor one, and still maintain schedule time. A good deal of this may be ascribed to the careful use of the brake. It is necessary, in making a fast schedule, with many stops, to shut off the power and use the brake almost before the car has gained headway. This frequent use of the brake is a temptation to many motormen to keep the slack of the chain taken up, so that a slight pressure on the brake handle will put the brakes on hard. This keeps the shoes in contact with the brakes at all times, giving excessive friction and loss of power. A good motorman will coast his car as much as possible when the schedule will permit it. It is certainly advisable to keep accurate record of the way the motorman manages his equipment, but inferences must not be drawn too hastily from such records. If a motorman in charge of an equipment wears out his brake shoes rapidly and comes in with the regulating resistances sizzling hot, the schedule on which he has been running must be considered. If he has been on a fast schedule with many stops and has followed it closely, the condition of his car signifies very much less than would be the case if he had an easier run and had failed to make schedule time. In forming an estimate of the qualities of motormen, train inspectors, conductors, and particularly of officials having men in charge, the writer has found first impressions to be exceedingly valuable. The well-known saying that the sober second thought is seldom wrong is not always correct. Judgment should, of course, be suspended until the second thought has been well considered, but the first thought may be right after all. It certainly has the advantage that it usually represents the only impression that the majority of people will consider, and hence, may be the popular impression, which, in street-railway work, at least, must be catered to.

After all has been said and done with reference to the manipulation of train service, it is interesting to know what results may be expected from good work in this department, and to exemplify these matters the writer again cites from his records cases which he ventures to think will justify the statement that the matter of train service is of great importance.

It is not always easy to record the income of a line; for instance, a passenger may take line A and ride on it for 100 yards and pay in his fare simply and solely because he can obtain a transfer on line D. Line A gets the credit on the books, and line D, which actually performed the transportation, carries the debit side of the account. There is nothing on the transfer to show whether the passenger rode a longer distance on line A than on line D, or vice versa. To be strictly accurate, the fare and the expense should be charged to each line in proportion to the distance the passenger was carried on each, and while attempts may be made to equalize the accounts in this respect, absolute accuracy cannot be hoped for. The results are, therefore, submitted subject to this criticism, and are the best that can be obtained under the circumstances. The following examples are taken from monthly comparison sheets. These sheets are made up from the reports of the conductors, the inspectors and the books of the company, and comprise the following data:

1. Receipts.
2. Total passengers.
3. Mileage.
4. Receipts per car-mile.
5. Number of trips.
6. Receipts per trip.
7. Average length of trip.
8. Average number of cars per day.
9. Average mileage per car per day.
10. Timetable cost.
11. Columns for the record of increase or decrease of these quantities over the same month in the previous year.

If the comparison sheet shows increased receipts, diminished mileage, diminished number of trips and diminished timetable cost, the result must be ascribed in a large degree to the management of the train service. I may cite as examples the following:

From a monthly sheet on a certain line the increase in gross receipts was $3,586, the decrease in mileage was 18,920 miles, due to the substitution of short lines for longer ones. The decrease in timetable cost was $1,612, representing an actual increase in revenue to the road of $5,198. This amount, as a monthly incentive for ingenious manipulation of the train service, is certainly attractive. On another line, almost as large, the increase in gross receipts was $13,765. It was, however, accompanied by an increase in timetable cost of $1,902, representing a net gain of $11,867, certainly a wise investment for the added expense. The large gain in gross receipts was due to changing of the terminus to a better center of distribution. This maneuver not only filled up the empty cars that were running formerly, but necessitated the running of additional equipments.

Another case may be cited, in which the gross receipts showed a loss of $7,087, and the timetable cost a decrease of $2,814, representing in total a loss of $4,273, as compared with the same month of the previous year. This, while not so pleasant for directors' contemplation, is very important to know. The reason for this was found in the fact that a number of large factories on the line had been shut down. It might have been due to local conditions, or that the train service could be improved.

In like manner, a yearly comparison sheet can also be drawn, and careful management can often in a well-established road increase gross receipts or largely diminish timetable cost. From such a sheet, involving a yearly total from 37 different lines, may be cited an increase of more than 10 per cent. in gross receipts and a little over one per cent. in timetable cost. The receipts per car-mile showed an increase of 5.8 per cent. The receipts per trip were increased 16.5 per cent. The average mileage per car increased 15½ per cent., whereby about 144,000 trips and the incident expenses were saved.

Such figures as these, on a system in which the building of new lines has been relatively small, can hardly be ascribed to growth and extension, and could scarcely be obtained except by running the cars longer distances and by suiting the public taste, whereby larger loads of passengers were carried, or, briefly and in other words, by improved train management.

Discussion.

President Sergeant: Gentlemen, we are to be congratulated on having so interesting a paper on a subject which, I think, has never been presented to us before. We are indebted to Mr. W. H. Holmes of Kansas City for the suggestion of this subject, and I think it is only fair to ask him to say a few words upon it.

W. H. Holmes, Kansas City: It seems to me that the employment of men is one of the important things to be considered, and I think it is pertinent. We have adopted a plan of setting aside a portion of one day in each week, which is Monday morning, from nine to 12 o'clock, to receive applications for employment, and at that time we generally call in some of the division superintendents to look the men over as they pass through the office. I think it is wise to have the men employed under you with you during these times, and after selecting what men we need, they are required to make out an application, stating where they have worked and giving us such references as they are able to give. We have found that to be the best way of handling the matter, and we have been able to get very good men. I have arranged this winter to give my men, the motormen especially, a course of lectures, and have arranged with Professor Black, one of the best lecturers in the West, to come to Kansas City and deliver to our men a lecture on the practical application of electricity, at least every two weeks during the winter months. Our company will carry the matter as far as the men want to go. If they want to take a course in electricity, we shall be glad to see them do it. My opinion about the train service is that we are merchants, and we are selling rides, and we should use great care in the selection of the men, as the company is almost entirely judged by its employes. We have followed the policy of promoting men from the ranks. We think that it is best to select married men, if we can find them.

H. H. Vreeland, New York: The work that we have in New York city, the greater part of the 24 hours, is to see how many cars we can run on the lineal feet of track which we have, consistent with right-angle crossings at various points. Right-angle crossings and terminals govern our headway more than anything else. The steam railroads of the United States last year handled 560,000,000 passengers, approximately, within the borders of the United States. We moved last year 265,000,000 cash passengers and 90,000,000 of transfer passengers.

Our system is handled with reference to timetables, and the method of regulating timetables and making timetables, on the same general plan as Mr. McCormack has suggested, and on the lines which we have frequently talked over together. The essential thing in arranging traffic, irrespective of volume, is a study of conditions. The division superintendent and the general foreman, with the amount of detailed business that they have devolving upon them are not the men who can make a timetable. I made all the timetables for one of the largest steam railways in this country for five years, and I would not attempt to make a timetable for one of our lines in New York. A study of the situation is made thoroughly, as indicated by Mr. McCormack, and then the timetable is laid out by a man who is employed for that purpose, and followed up in that way. East and west of Central Park in New York, there are three lines on each side of the town. The regulation of the car conditions on these lines were almost equal during the early hours of the day; but a close study of the people and their peculiarities brought us to the conclusion that on the east side of the town the large-car service should be started at six o'clock in the morning, and the large-car service on the west side of the town should be started at half-past eight o'clock in the morning. We were previously running very nearly the same service on both sides of the town, and the change meant, of course, the saving of a great deal of money.

On the question of the average of speed, etc., we have to study these factors very closely to keep these things moving. We found it was impossible, even on short distances, to keep up the voltage of our lines during the hours of heavy loads—to maintain any satisfactory regulation, taking the current direct from the generators. We had to put in a 4,000 horse power storage-battery plant which is automatic in its action, to keep the voltage up so we could do our business. For a long time there was a question of what affected the timetables. We sent out men to take measurements, and it was determined that it was not the fault of the motormen, although they were blamed for it. They would have a car full of passengers, and the voltage was down to 400 or 450. By the increased power obtained through the use of the storage-battery plants we keep a uniform voltage of approximately 550 volts and meet the condition in that way.

I think that traffic diagrams are the most important things for a man to have in connection with the operation of a street railroad. We have traffic diagrams taken at least once in every two weeks of every division of our system for the 24 hours—passengers against hours—and a copy of that is furnished to the general foremen or inspectors on the line, as well as the man who makes the timetables. Our diagrams go into the volume of business, showing the number of passengers carried per hour in each direction on every line of the system, in the 24 hours. Thus, between nine and 10 o'clock 4,000 passengers went south, and from nine to 10 o'clock 3,000 passengers went north, over the system. It is impossible to get any system of accurate inspection that will show where these people get on and off, without supplementing this work by the system which Mr. McCormack indicated of special inspectors at certain points. I can say, heartily agreeing with the paper of Mr. McCormack, that it is very valuable for all of us to consider in connection with our work, and that it would be utterly impossible for us to do the business we do in New York city, running the number of cars and handling the number of people we do every 24 hours, without making this one of the very important studies of our transportation department.

It is our practice to subdivide the blue-print sheets, using the upper half for the 24 hours southbound and the lower half for the 24 hours northbound. We show a clean sheet of southbound and northbound business on the same sheet, the two peaks coming together toward one another and practically making it the same, although they are distinct in their location on the chart.

A. C. Heidelberg, Chicago: The greatest trouble to-day in our train service in Chicago is something we do not seem to be able to cope with, and we have tried it in every way, and that is the trading of transfer tickets at transfer points. I understand that in New York city they have had this matter before the state courts, and I would like to hear what they did with it from Mr. Vreeland.

Mr. Vreeland: Do I understand that the gentleman wants information in reference to those specific cases where arrests were made?

Mr. Heidelberg: No; information of a general nature. The situation here is that anyone riding over a line in Chicago will find at transfer points boys who get the transfer tickets and sell them, and another passenger will ride on the original nickel paid the company. I understand that they tried to stop this practice in New York.

Mr. Vreeland: I fully appreciate the difficulty under which they do their transfer business in Chicago, because in walking uptown the other day, I stepped into a drugstore to buy a cigar, and when I was going out the clerk said, "Are you going to take the cars? If so, here is a transfer." The transfer went with the cigar. The history of this thing in New York is a long matter of detail, too long to bring before the association at the present time, and I would suggest for the information of the gentleman that this subject was very thoroughly discussed, not only by our attorney, but by the men who are at the head of our transfer business, together with the gentlemen who handle the transfer system of the Brooklyn Heights railroad, which is as intricate as ours, at the convention of the New York State Street Railway association of the state of New York, held last month at Ithaca, and while I would be glad to give the information now, I appreciate the fact that it would be altogether too long to take up the time of the convention to do it. The answer of our attorney to a similar question propounded by someone with reference to the effect of that law was very full.

W. S. Dimmock, Council Bluffs, Ia.: I would ask Mr. Vreeland what laws in the state of New York, if any, govern the crowding of the platform, and what the rules of the company are pertaining to the passengers crowding the rear platform of the cars?

Mr. Vreeland: There are no regulations on this matter except the regulation of the Board of Railroad Commissioners that passengers shall not be allowed on the front platform with the motorman,

of either open or closed cars. We did not follow it, and a law was introduced to compel us to close the front gate and also keep passengers off the front platform. I went to Albany and made an argument against the proposed law, stating that the railroad company had absolutely no interest in it—that the law would not regulate the railroad company at all, but would regulate the public, and that if the law was put into effect under this regulation, the public would be told that so many thousand of them must not go home until nine o'clock at night, and they would at any rate have to delay their dinner.

Mr. Dimmock: Have you not some law governing the rear platform in regard to the crowding of the rear platform so as to make it inconvenient for other passengers to get into the car?

Mr. Vreeland: There is no regulation, either municipal or state, on that question. We have, as probably you gentlemen all know, the double door in New York city, which opens practically the full width of the rear platform, and we insist that our conductors shall not allow passengers to stand on the platform on the side on which passengers are getting on, but that is not followed out very carefully. I want to say, to show you how peculiarly we are situated in that respect, that the Board of Railroad Commissioners, with its inspector, came down last winter and looked the situation over thoroughly with reference to our Fourth and Madison Avenue line, and the commissioners said after their inspection: "We have nothing to recommend, and we do not see what you can do unless we say the people shall not ride; you are running as many cars as you can, and running them to the fullest limit during rush hours. You are running with regularity and dispatch and doing everything you can to handle the people, and we must place ourselves in the position, not of saying to you what you shall do, but saying to the public what it shall do:" and they, as a matter of course, in their own interest, do not care to tell the public what it shall do.

CORRESPONDENCE.

New York Notes.

New York, November 18.—The Rapid Transit Commission has advertised for bids for the contract to build the underground railroad. No bids have been received as yet by the commissioners nor do they expect any until near the time for closing, which has been set for January 15th. However, there are persistent rumors in relation to the identity of the prospective bidders. One of the local papers states that no less than three responsible companies and two syndicates intend to put in bids. The companies mentioned are the New York Central Railroad, the Third Avenue Railroad and the Metropolitan Street Railway companies. A local and an English syndicate are the other two reported prospective bidders. But President Vreeland of the Metropolitan company says that his company has no intention of bidding for the tunnel and that the stockholders of the company have no intention of organizing another company for the construction of the underground railway.

The Third Avenue Railroad company has started the running of its new cars on the One-hundred-and-twenty-fifth street branch, and within 10 days expects to have 100 or more of them in operation. The cars are 41 feet over all, with cross seats, and are illuminated by 20 electric lights. They will seat 40 persons and are provided with air brakes. Work on changing the motive power from cable to electricity on the line from the postoffice to Harlem was begun to-day, and it is hoped that it will be operated electrically next Tuesday.

In all probability automobiles will soon be admitted to Central Park without permits. President Clausen of the park department has already given one or two permits to automobile owners to enter the park, and as the horses that are driven in the park become accustomed to seeing the horseless vehicles, he says the number of permits issued will be increased. If future trials are satisfactory he will introduce to the board at some future time a resolution rescinding the prohibitory resolution against automobiles in the park.

The Fifth avenue stage line has been sold to the New York Electric Vehicle Transportation company by William C. Whitney, who acquired control of the stage line about a year ago from the Third Avenue Street Railroad company. It is stated that the road will be equipped with the latest style of electrical stages as soon as they can be constructed. It is believed that the stages will be built by the Electric Vehicle company, with which Mr. Whitney is prominently identified.

On account of an assertion made by an electrician that all a bank burglar had to do to open a steel vault was to embezzle an electric current from the nearest trolley line, burn a hole in the safe large enough to permit the insertion of his hand, and take out the assets of that institution, several New York banks recently employed men to test the possibility of electric safe-breaking. A lot of journeymen electricians were set to work upon the vaults of a friendly bank, but the electrical burglary proved to be a tedious and complicated process. After spending considerable time in getting their machinery in place, the safe-breakers found that they could not steal enough electricity in the vicinity with which to burn a sufficiently large hole in a steel door without making a special arrangement with the street-railway company.

For three days last week the price of No. 1 leather for belting purposes rose one cent a day a pound. No one is predicting what the price next week will be. The scarcity of hides is due to the heavy shipments to England in the last two or three years, when tanners would not buy from the packers of hides. Leather-belting manufacturers met in this city and raised the price 30 per cent. A movement has been started in Boston to bring back the exported hides to this country by asking Congress to repeal the duty on hides. This duty is about 18 per cent., equal to seven cents a pound at the current price of 40 cents for oak butts.

The Brooklyn Union Gaslight company is removing an old gas main on the south side of Myrtle avenue from Broadway to Franklin avenue. Italians are employed in digging a trench and removing the pipe. Shortly before noon on Wednesday a trolley wire over the up-tracks parted and fell on the rail nearest the trench. It formed a circuit and the accumulation of gas in the ground and in the trench from the old main was exploded. All the Italians were knocked down and windows in houses for a block around were broken. The damage was placed at $500. M. L. G.

PERSONAL.

Hugh S. Carr, formerly with the Warren Electric Manufacturing company of Sandusky, O., has accepted a position as instructor in the electrical engineering department of the University of Kansas at Topeka.

Frank Engelhardt, formerly connected with the Greene-Wheelock Engine company, is engaged in engineering work in Chicago, being at present mechanical engineer for the Calumet Grain and Elevator company. Mr. Engelhardt also handles the Chicago business of the Filer & Stowell company of Milwaukee.

Mr. John M. Roach, the general manager of the Chicago Union Traction company and the recently chosen president of the American Street Railway association, was elected vice-president of his company in place of Walter H. Wilson, resigned, on Monday. This important promotion is a well-deserved recognition of Mr. Roach's ability.

Messrs. J. K. George and C. E. Lee of the Leecoll Electric Battery company of London are in the United States on business connected with that company. Mr. Lee, like Mr. George, is an American and was a well-known electrical man in Chicago before his departure for England, less than three years ago. He states that the outlook for the electrical business in Great Britain is good, particularly in the electric-railway and automobile lines.

ELECTRIC LIGHTING.

Recent statistics show that of 140 cities in the United States having a population of 30,000 or over four have municipal gas works—Duluth, Richmond, Toledo and Wheeling—and 13 own and operate electric-light plants.

The Union Water, Light and Power company has filed articles of incorporation in Newark, N. J. The company is capitalized at $1,000,000 and S. N. Blake, F. W. Garvin and C. M. Vail are among the incorporators. East Orange is named as the location of the principal office.

The Chicago Edison company is installing in its Washington avenue station a 1,500 horse power, direct-connected unit, which will bring the capacity of the station up to about 9,000 horse power. The engine is of the Southwark tandem-compound type and the generator is a General Electric 1,000-kilowatt, 18-pole and 120-revolution machine. It will operate on the Edison three-wire, direct-current system at 300 volts.

Propositions from 15 different firms have been received by the Navy Department for the installation of an electric-lighting plant at the United States Naval Academy, Annapolis, Md. Bids were received as follows: For the entire work, Morton, Reed & Co., Baltimore, Md., $43,740; dynamos and switchboards, Northern Engineering company, Bayonne, N. J., $23,550; boilers, Crook, Horner, & Co., Baltimore, Md., $8,700; engines, Crook, Horner & Co., $10,227.

The Consumers' Electric Light company of Tampa, Fla., the property of which was recently sold at receiver's sale, is succeeded by the Tampa Electric Light company. The following-named are the officers of the new company: President, George J. Baldwin; vice-president, Peter O. Knight; general manager, H. G. Bradley; secretary and treasurer, Eliot Wadsworth. These gentlemen, with W. H. Blood, Jr., constitute the board of directors. The capital stock of the company is $500,000.

ELECTRIC RAILWAYS.

The right-of-way is being secured for the construction of an electric railway between Port Huron and Caro, Mich.

E. G. Endress & Co. have been granted a franchise for an electric railway by the Sault Ste. Marie (Mich.) council. The franchise covers all of the principal streets of the city.

The Chicago General Railway company has issued a statement which shows that the system of two and four-cent fares recently instituted on its lines has resulted in a 16 per cent. gain in gross receipts and 234.10 per cent. gain in the number of passengers carried.

During October the South Side Elevated Railroad company of Chicago collected a total of 2,287,583 fares, the daily average being 73,793. This is an increase of 15,595 over the business of the corresponding month of 1898 and 14,208 over the business of September this year.

AUTOMOBILES.

A London dispatch states that the British Automobile Club is arranging a 1,000-mile road trial. The route will probably be from London to Edinburgh and return, running up through Bristol, Birmingham, Liverpool, Sheffield, Newcastle and Glasgow.

The Messerer Automobile company had articles of incorporation recorded in Newark, N. J., recently. It will manufacture automobiles of every description. The capital stock is $300,000, of which $2,200 has been paid in by Stephen Messerer, Joseph Fisch, Julius E. Seitz and Adolph Goldfinger, all of Newark.

A Philadelphia man, recently returned from Paris, gives the following figures to show the cost of operating an automobile in that city for a year: Gasoline, $87.50; lubricating oil, $5.45; repairs to carriage, $102.50; repairs to machinery, $185; repairs to tires, $27.50; sundries, $64.80; depreciation, $150; tax, $50; servant, $200, making a total of $872.75.

Announcement has been made of the consolidation between the International Automobile and Vehicle Tire company of New York and the New England Rubber Tire Wheel company of Boston. The first-named company is said to have acquired the business of the rubber-tire company, including several valuable patents. The amount involved in the transaction is about $1,000,000. Edward E. McCall is the president of the International Automobile and Vehicle company, and Richard Croker, Jr., is the vice-president and general manager.

PUBLICATIONS.

The twenty-first edition of the American Settler's Guide, a popular exposition of the public-land system of the United States, has just been edited by Henry N. Copp.

A booklet containing a treatise on the use of insulating varnish has been recently issued by the Sterling Varnish company of Pittsburg. It also contains fac-simile letters of recommendation, orders, etc., and is intended for distribution to the trade throughout the country. French and German editions of the booklet will be distributed in Europe.

The Manhattan Electrical Supply company, 32 Cortlandt street, New York, has just issued the eleventh edition of its catalogue. The catalogue is full of descriptions of things electrical and is well arranged. This concern does its own manufacturing on a large scale and is in a position to sell its goods at low prices. The catalogue will be sent free on application.

SPACE TELEGRAPHY.

It is stated that the new British battleship Canopus will be fitted with the Marconi system of space telegraphy.

It is announced that a new company, to be known as the Wireless Telegraph and Telephone company, is soon to be incorporated in New York. The capital stock of the company will be $12,000,000, and is to be owned chiefly by New York, Boston, Chicago and Philadelphia capitalists.

Orders have been issued by General Greely for the establishment of a wireless-telegraphy plant at Fort Myer, Va., which will be in the nature of a school at which officers and men of the army will be instructed in manufacturing apparatus for sending and receiving messages without wires, and where men are to be made operators of the new system. An experimental station to talk between the War Department and Fort Myer is also to be established.

The advisability of installing the Marconi space-telegraphy system upon Mount Blanc is being considered by the director of the Mount Blanc Meteorological Observatory. The ordinary system of telegraphy is used normally, but the great snowdrifts have played havoc with the telegraph wires. It is believed that the wireless system of telegraphy would prove not only valuable from a scientific point of view, but would also increase the safety of travelers upon the mountain.

When the steamship St. Paul, bearing Mr. Marconi, neared the English coast on November 15th, Mr. Marconi, from apparatus attached to the mainmast, established communication with wireless installations at Alum Bay and Poole and received dispatches from both points regarding the progress

of the war in South Africa, the wreck of the United States cruiser Charleston and other important events. The passengers also availed themselves of the opportunity to send "wireless greetings" to friends in England, one man arranging for a supper party in town on his arrival in London.

It is asserted that the War Office of England has contracted with the Wireless Telegraph and Signal company for the use of the Marconi system in South Africa for a period of six months. Captain Kennedy, R. E., superintendent of railway telegraphs, Natal, is stated to have left Southampton for Durban, taking six sets of apparatus and a staff of assistants and operators. It is said that the first installation will be for communication between Durban and the bar off the port. It is outside this bar that the troops from England are disembarked into tenders for landing. By wireless telegraphy these operations may be facilitated.

Frederick J. Cross, a capitalist of Honolulu, is said to have obtained the right for the use of the Marconi system between five of the largest of the Sandwich Islands. The contract has been made with the London Telegraph and Signal company, the corporation handling the Marconi patents, and a company has been organized with a capital stock of $100,000 to further the project. Communication between the five important islands of the Hawaiian group is at present restricted to boat trips twice a week, as cables between the islands cannot be laid, since the coral reefs, which abound in the archipelago, cut and mangle any wires that may be laid.

MISCELLANEOUS.

At the regular meeting of the Chicago Electrical association on December 1st E. P. Warner, electrical engineer for the Western Electric company, will deliver a paper on "Alternating-current Arc Lamps."

A quarterly meeting of the New York State Electrical Contractors' association was held in Troy on November 14th. Sixty contractors from the eastern part of the state were present. The business transacted was mainly routine. Rudolph Schmidt of Rochester is president of the association and Wells Dygert of Buffalo is secretary.

Major W. C. Beevor of the Royal Army Medical Corps has sailed from England for South Africa, taking with him a complete X-ray equipment for surgical use. Major Beevor's practical experience with the apparatus in Indian warfare renders him well suited for the present service. He takes with him an influence machine to operate the apparatus.

The recently incorporated Electrical Construction and Maintenance company has organized by electing the following-named officers: President, Henry Hess; vice-president, Dr. J. H. B. Amick; general manager, George J. Jewell; directors, Harry R. Schock, George Egolf, John Kellerman, J. Hardardt, Charles Reber and S. T. Martin of Camden, N. J. The new company was organized under the laws of New Jersey, with a capital stock of $100,000.

A meeting of the National Electrical Trade association, held in Boston November 10th, was attended by a number of representatives from outside cities and over 20 members of the local body. Considerable important business was transacted, including the adoption of resolutions favoring the establishment of a credit bureau to give advance information, etc., and circulate data concerning the accounts of newcomers in the electrical industry. The association elected as officers for the ensuing year the following-named gentlemen: President, C. W. Wilkins of Philadelphia; vice-president, W. M. Carpenter of Chicago; general secretary and treasurer, F. P. Vose of Chicago.

TRADE NEWS.

The Electric Appliance company, Chicago, is sending out samples of its new Eaco tape. This tape is composed of one-third pure rubber and has the necessary qualities that will recommend it to the trade.

George W. Lord, manufacturing chemist, will remove his laboratory and plant to 2238-2250 North Ninth street, Philadelphia, about January 1st. The new building is a large one, and the equipment will include the very latest apparatus for manufacturing the chemicals used in the preparation of the formulas of Lord's boiler compounds.

Mr. H. P. Feister, the recent proprietor of the Franklin Electric Supply house of Philadelphia, has sold the good-will, stock and fixtures of that business to the H. C. Roberts Electric Supply company of 831 Arch street, Philadelphia. Mr. Feister, whose health obliges him to retire, commends his successor, Mr. Roberts, to the favorable consideration of the electrical trade.

Many people do not know the value of burned-out or broken incandescent lamps and bases, and to such persons the firm of George F. Schwalm & Co. particularly addresses itself. This firm has been in business for the last seven years and is said to be the largest dealer in burned-out lamps in the country. Its prices and terms may be had by addressing it at Harrison, N. J. That it is in business to stay is proved by the manner in which its business has grown during the last seven years. Not only does it pay the highest market prices, but it pays spot cash in advance to all who desire it. It also pays freight charges and guarantees satisfaction in every way. Another offer which these people make is to sell at low prices new and renewed lamps, which they guarantee in every way and ship on 60 days' trial, with the privilege of returning the lamps at their expense if not found satisfactory.

The electrical fraternity in general and users of incandescent lamps in particular will doubtless be interested in the announcement of the Kentucky Electrical company, Owensboro, Ky., manufacturer of incandescent lamps. The factory of this company is said to be the first of its kind in the South, and, although in existence only about a year, the company has made great strides, the lamp having met with favor by all who have given it a fair test. The Kentucky company makes a number of strong claims for its lamp, which it guarantees to produce a pure, white light and to maintain its candle power throughout its entire life. This, the company claims, is due to the perfect vacuum of the lamp. The factory of the company is equipped with all the latest appliances used in the manufacture of incandescent lamps, and it is stated that the demand for the Kentucky lamp has been so great that the facilities for its manufacture are already becoming taxed to their utmost capacity. John G. Delker is president of the company, J. W. McJohnston vice-president and A. L. Parrish treasurer. A. H. Kreitler, the secretary and manager, has had a wide experience in the manufacture of incandescent lamps. The company is meeting with better success than its incorporators anticipated, and if the present high efficiency of the lamp is sustained the demand will no doubt continue to be satisfactory.

BUSINESS.

The Federal Battery company of New York, which manufactures Federal salt and Federalite for batteries, reports a very large business so far this month. The company's telephone business especially is said to show a decided increase of interest among telephone users, and the jobbing trade reports a good demand for the firm's products.

The Western Electric company is installing three 70 horse power motors in Schlesinger & Mayer's building, Chicago. These motors are especially designed to drive the pumps for the elevators and are to work against a constant pressure of water at all speeds. The speed variation, which is from 175 to 350 revolutions a minute, is governed by an automatic controller which cuts in or out various sections of series-field winding.

The Chicago House Wrecking company, which recently purchased the buildings and equipment of the Omaha Exposition, including everything remaining on the grounds, is offering for sale the goods and material that thus came into its possession. The list of mechanical and electrical apparatus is quite complete, comprising, as it does, everything from a miniature incandescent lamp to a 400 horse power engine. Buyers of electrical goods are requested to send to this company for its catalogue No. 156, as the quotations for new and second-hand material are from 10 to 50 per cent. below present market price, it is said.

Seymour Swarts, president of the Swarts Metal Refining company of Chicago, announces that his company is in the market for scrap platinum in any quantity, for which it pays the highest cash price. The company also purchases burned-out incandescent-lamp bases, from which it extracts the platinum, allowing the full market value less the cost of extracting. In addition, the Swarts company buys scrap copper, wire, brass, etc., from electric-light and street-railway plants.

The Incandescent Electric Light Manipulator company of 116 Bedford street, Boston, Mass., wishes to direct the attention of users of incandescent lights to its manipulator for reaching lamps in out-of-the-way places. Style No. 4 is made for cleaning bulbs only, is three feet in length and can be attached to any pole. The claim is made that by the use of these cleaner attachments a considerable saving is made in the use of the light, by the superior cleanliness and efficiency of the lamps.

There was shipped from East Berlin, Conn., recently, a train load, comprising about 27 cars, of structural material from the works of the Berlin Iron Bridge company, consigned to the United States Commission at Paris, France. This material will constitute a very important element in the American exhibit at the Paris Exposition, as it is intended for the steel framework of a machine shop to be used exclusively by the American exhibitors of iron and wood-working machinery at the Paris Exposition of 1900.

A. C. Becken, the well-known jeweler of Chicago, announces an increased demand for Paillard non-magnetic watches, which are so favorably known by many electrical men. The Paillard watch is uninfluenced by magnetism, as is claimed, and it is carried by thousands of men whose duties bring them in constant proximity to electrical machinery. The Paillard watch is said to be indorsed by many prominent electricians and scientists. An interesting descriptive circular will be sent on request to A. C. Becken, 103 State street, Chicago.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, report a large demand for machinists' tools and supplies, shipments being made to all parts of the United States and Canada. On Helmet oil and Perfection and Bonanza cups contracts have already been closed for future delivery far in excess of any former years. The factory at Beloit, Wis., is being run overtime in many departments to meet this demand. Recent shipments to India, Argentina, France, Germany, Russia and England are noted. Besly & Co. are introducing a new machine known as the Gardner band grinder, and will submit descriptive matter upon application.

One of the largest electrical supply houses in the country is the Manhattan Electrical Supply company, 32 Cortlandt street, New York. As is well known, this company is in a position to furnish everything in the line of electrical supplies, from the smallest article to the largest. The company manufactures a large percentage of the goods described in its new and handsome catalogue, No. 11, which contains 352 pages and which will be sent on request. The company states that it has sold over a million of the well-known Mesco dry-battery cells which it manufactures. The Manhattan company is said to be quoting exceptionally low prices on telephones and telephone supplies at the present time.

Every electrical man who has been unfortunate enough to be severely burned by a live wire or otherwise realizes the importance of having on hand something that will ease the pain of a burn. It is asserted that this is easily accomplished by "Vitogen," a powder that is said to be an exceptionally good antiseptic dressing for burns, scalds and other wounds. The G. F. Harvey company, Saratoga Springs, N. Y., manufacturing chemists, prepare "Vitogen," which is stated to be highly recommended by many physicians. The Harvey company will be pleased to mail a 52-page book, entitled "Vitogen in Practice," which tells how it saved one electrician's life. "Vitogen" is said to be a necessity that no electrician should be without.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 14, 1899.

636,748. Rock or Coal-drilling or Other Machine. Henry H. Bliss, Washington, D. C. Original application filed December 24, 1886. Divided and this application filed August 6, 1895.

There are provided an electric motor for imparting rotary motion to the shaft of the machine and a supplemental electric motor for moving the shaft longitudinally.

636,773. Loom. William C. Edler and Frank Windle, Philadelphia, Pa. Application filed February 27, 1899.

In a loom an electromagnet and an electric circuit for the magnet are combined with contact devices connected with the circuit and adapted to be moved into and out of contact by the action of part of the loom mechanism.

636,776. Means for Generating Electricity from Car-wheel Axles. Pursell Eggleston, Newark, N. J. Application filed April 19, 1899.

In this invention a dynamo secured to the truck frame of a car is driven by a belt passing over a driving pulley on the car-wheel axle, and also over a pulley wheel on an adjusting device pivotally connected with the truck frame.

636,779. Electrical Bell Ringer for Street Cars. Francis A. Enz and William H. Fetter, Pittsburg, Pa. Application filed July 6, 1899.

A bell or gong-ringing mechanism is described which combines a cootroller stem, a controller lever, an insulated collecting drum mounted on the controller stem, collecting rings mounted on the drum, a bell or gong having electrical connections with a feed wire or dynamo, brushes adapted to contact with the collecting rings and having electrical connections with the bell or gong and ground, and means arranged in the controller lever and adapted to complete the electrical circuit through the cootroller stem to operate the gong.

636,804. Quick-break Electric Switch. George L. Holton, Utica, N. Y. Application filed March 25, 1899.

The switch combines terminals, pivoted main and snap blades, a lockiog plate or latch slidably mounted in the snap blade, a lever engaging the latch and connecting arms pivotally secured at one of their ends to the snap blade, the other ends of the arms being connected with the lever.

636,871. Ceiling Fan Motor. Henry H. Wait, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed January 16, 1899.

The apparatus comprises a magnet frame and brackets mounted on the frame, journals formed in the brackets, an armature within the frame having a tubular shaft journaled in the bearings, and a fixture support projecting freely through the shaft and carried in the upper bracket.

636,872. Telephone Trunk-line Signaling. Thomas C. Wales, Jr., Newton, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed August 17, 1899.

A trunk line between two telephone switchboards, having conductors common to a metallic talking circuit, and

a grounded signaling circuit, are combined with a ground connection for the sigoaling circuit at one end of the trunk; a supervisory relay in the talking circuit, a complementary ground connection for the signaling circuit, and a supplementary relay in a local circuit adapted to be closed through the trunk-circuit switch devices, all at the other end of the trunk; and means controlled in part by the supervisory relay and in part by the supplemeotary relay for attaching and detaching the complementary ground connection, as required.

636,875. Electric Arc Lamp. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed April 1, 1899.

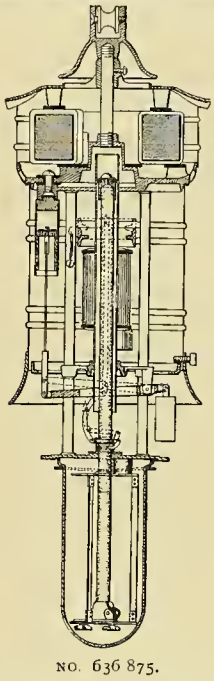
The regulating magnet and its aluminum armature of the lamp are adapted to be repelled when alternating currents traverse the magnets. The armature comprises two rings, one for each of the projecting cores of the electromagnet, the rings being connected together by bars formed integral therewith to leave an opening midway between the rings. A tubular guide for the upper carbon passes through the opening, and clutch mechanism is directly attached to the armature, the weight of the armature and the moving parts carried thereby being counterbalanced. (See cut.)

636,881. Electric Band. Joseph M. Wolkosky, Irwin, Pa. Application filed April 4, 1899.

The band consists of two sections, one constructed of zinc and the other of copper, a hinge connecting the one end of the sections together, and means for securing the opposite ends of the sections together.

636,897. Electric Generator or Motor. Charles H. Cutting and George H. Cutting, Derby, England. Application filed August 23, 1899.

In the apparatus described, a yoke is provided with a transverse opening, and a field magnet is connected with the yoke and projects through the opening.



NO. 636 875.

636,905. Distributing Panel for Electric Circuits. Charles J. Klein, New York, N. Y. Application filed March 31, 1897.

A fuse holder is described which combines a plurality of apertured recessed sections placed together with their recessed portioos in communication with each other, a bridge wall dividing the recessed portions into two compartments, the bridge wall being of diamond shape and having the points of the diamond opposite apertures in the wall of the fuse holder.

636,910. Electric Alarm System. Richard R. May, San José, Cal. Application filed June 17, 1899.

The system combines a source of electricity, two normally open circuits including the source and having a common return, an electric alarm located in one of the circuits and having a conductive base in its local circuit connected directly with the common return, an electromechanical circuit-closer included in the second circuit and adapted to close the circuit of the alarm, and a circuit-closer for the second circuit including a terminal adapted to engage the base of the alarm, with the head hinged to the arm and comprising two parts, one of the parts being capable of rotary adjustment and provided with a spindle.

636,937. Electric Railway. William H. Wright, Buffalo, N. Y. Application filed October 31, 1898.

A magneto-electric system of propelling cars is described which comprises a conduit, a conductor in the conduit, a temporary conductor parallel with the main conductor, intermediaries between the main and temporary conductors, means on the car for magnetically influencing the temporary conductor, a contacting device on the car, suitable wiring thereon, and a motor on the car, the intermediaries being suspended from the lower side of the temporary conductor and always in positive, continuous contact with the temporary conductor.

636,938. Manufacture of Electric Batteries. Edward Baines, New York, N. Y. Application filed June 7, 1898.

A method of compounding lead oxide, sulphuric acid and finely divided charcoal is described which are used in the manufacture of secondary batteries.

636,956. Process of Making Battery Cups. Frank G. Curtis, Everett, Mass., assignor to the Automatic Electric Pump company, Boston, Mass. Application filed May 10, 1897. Renewed April 20, 1899.

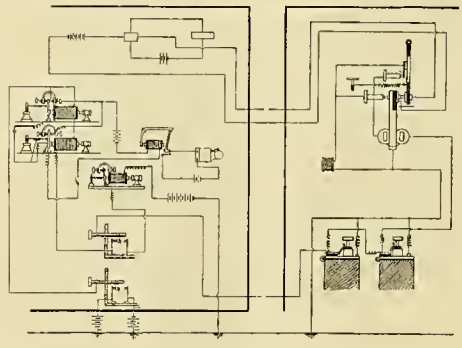
The process described for preparing clay prior to forming it into porous cups for use in electro-galvanic batteries consists in mixing the clay with a solution of water and hydrate of potassium and afterward passing an electrical current through the mixture.

636,964. Electric Vehicle. Theodore B. Entz, Philadelphia, Pa. Application filed August 5, 1899.

The vehicle comprises a truck consisting of axles and their wheels and perches or reaches rigidly attached to the axles, a motor mounted on the truck, a battery box, a carriage body, springs interposed between the battery box and the truck and openings interposed between the body and battery box.

636,965. Electric Vehicle. Theodore B. Entz, Philadelphia, Pa. Application filed August 5, 1899.

In this vehicle two sets of springs are provided, one being ioterposed between the truck and the carriage body and the other between the battery box and the truck.



NO. 637,012.

636,980. Truck for Electric Cars. John Goettei, Boston, Mass. Application filed April 18, 1899.

The truck has a meta'lic framework, a transom block, a spring between the transom block, and a base piece which serves as a foot piece for the spring and forms an integral part of the motor support.

636,989. Quick-break Electric Switch. Robert B. Hewson, San Francisco, Cal., assignor of one-half to Austin Kanzee, San Francisco, Cal. Application filed May 17, 1899.

The switch consists of a pivoted lever arm, connections between one of the terminals and this arm, a conducting tube with which the other terminal is connected, a tube or bar slidable within this tube, compressing spring plates connected with the upper part of the slidable part, between which plates the lever arm is retained by friction whereby the inner tube may be withdrawn with relation to the outer tube, and a stop to limit the movement of the tube whereby the lever arm may be withdrawn from between the compressing plates, and a spring by which the tube is suddenly retracted when the contact is broken.

637,006. System of Electric Traction. Lowell M. Maxham, Boston, Mass. Application filed February 25, 1899.

In the system a mechaoically continuous but electrically broken intermediate conductor normally supported with its upper face flush with the top of the channel containing it is in combination with the confioing walls forming the channel, and means whereby the local depression of the intermediate conductor shall put the local portion of the conductor into contact with an electric terminal.

637,012. Electric Burglar Alarm. George McGann, St. Louis, Mo., assignor to the Commercial Telegraph company, St. Louis, Mo. Application filed March 21, 1898.

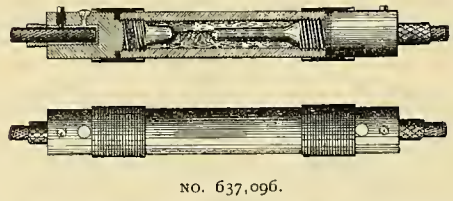
The system consists of a protection circuit, a polarized relay having an armature provided with a section of insulating material in its end, contact points secured to the metallic end of the armature and to the insulating material, a resistance coil located in the protection circuit adjacent the polarized relay, a balanced relay located in the central station and connected with the protection circuit, a relay comprising an audible signal and connected with the balanced relay, and a push plug which synchronously operates the polarized relay, balanced relay and the audible signal. (See cut.)

637,057. Electric Igniter. Charles D. Wright, Chicago, Ill., assignor to the Advance Specialty company, Chicago, Ill. Application filed July 2, 1898.

An electric battery is combined with a tubular handpiece electrically connected with the battery, having at its end a contact point, and provided with means to retain the substance to be ignited near the point.

637,058. Electric-lighting Attachment for Gas Fixtures. Charles D. Wright, Chicago, Ill., assignor to the Advance Specialty company, Chicago, Ill. Application filed February 27, 1899

A battery and a coil located in the casing of a gas-pipe and electric connections uniting the battery and the gas-burner, and the coil and gas-pipe respectively are combined with means to complete the electric circuit to produce a spark near the burner.



NO. 637,096.

637,059. Combined Typewriter and Telegraphic Transmitter. Charles E. Yetman, Oak Park, Ill., assignor to the World Flash company, Chicago, Ill. Application filed Januray 20, 1898.

One claim reads: The combination with the finger keys and with the corresponding set of circuit rings controlled thereby, of the upright slotted reciprocating shifters interposed between the keys and bars and in co-operative union with each, the comb-like bar receiving the respective shifters between the teeth thereof and the guide rod extended across the comb bar and over which the shifters can be freely dropped at their open slots to assume working position.

637,060. Electric Arc Lamp. Thomas E. Adams, Cleveland, O. Application filed November 8, 1898.

In toe lamp are combined a clutch ring, a lifter connected with the clutch ring at one side of the carbon, a pivoted lever, a rod connected with the lever at a point between the ends of the latter and resting on the clutch ring at the same side of the carbon as the connection of the lifter with the clutch ring, and an air-pot having its plunger connected with the free end of the pivoted lever whereby when the lifter is actuated air will be compressed in the air-pot before the clutch raises the carbon.

637,071. Electric-battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed December 31, 1898.

The compound is composed of a bisulphate of sodium and an active oxidizing agent in a dry condition.

637,072. Electric Battery. Henry Blumenberg, Jr., and Frederick C. Overbury, New York, N. Y. Application filed March 13, 1899.

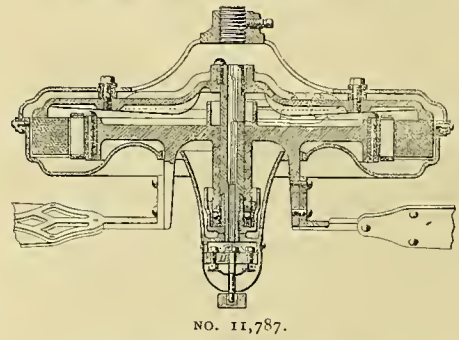
The carbon electrode in the form of a cup has through the rim at one place a hole for the free passage of the conductor and its iosulating covering. There is also a channel in the bottom of the carbon electrode and a connection between the end of the conductor and the bottom of the carbon electrode.

637,073. Thermostatically Actuating-valve Mechanism and Alarm. Albert Borden, St. Louis, Mo. Application filed February 9, 1899.

A valve controlling the heat supply in a building is actuated by a thermostat which also operates an electric alarm bell.

637,096. Safety Contact Interrupter for Suspended Electric Wires or Cables. Roger Ducornot, Puteaux, France. Application filed March 11, 1899.

A contact interrupter for breaking the circuit as soon as there is a breaking of the cable is described which consists of a thin celluloid tube or casing closed at each end by metallic stoppers to which are united the two ends of the electric wire or cable, the tube containing mercury, oil and a small quantity of petroleum. (See cut.)



NO. 11,787.

637,115. Residence Electric Plant. Grant M. Hise, Assumption, and John W. Eckman, Arcola, Ill. Application filed February 24, 1899.

In a working circuit including a dynamo and lamps or the like, an automatic cut-out is provided for breaking the circuit which consists of a fixed contact, an electromagnet, an armature pivoted at one end and located below the electromagnet, means for limiting the downward movement of the armature and holding it in a predetermined position, and a movable contact pivoted to the free end of the armature and normally in clutched engagement at its free end with the fixed contact, the armature and pivoted contact being raised upon the amperage of the electromagnet increasing beyond a given point, whereby the pivoted contact is released and falls away from the fixed contact.

637,119. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa.; assignor to the General Electric company of New York. Application filed July 20, 1894.

In a system of electrical distribution there are combined a stationary source of electric energy, positive and negative main conductors extending from the source of electric energy to a distance, a long-feeding conductor leading from the source of energy and connecting with one of the main conductors at two distantly located places, and a potential-increasing device arranged at a great distance from the source of energy and in the feeding circuit between the two connections with the main conductors.

637,120. Manufacture of Electrical Fuses. Rudolph M. Hunter, Philadelphia, Pa. Application filed November 11, 1896. Renewed May 1, 1899.

A machine for making electrical fuses is described which has a mold, a pressure device for introducing into the mold a fusible alloy under a predetermined pressure, and an automatic pressure-regulating device constructed and arranged to be actuated by the pressure device.

637,195. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed June 26, 1899.

An electrically controlled weft-supply mechanism for looms is described.

REISSUE.

11,787. Electric Motor. Charles R. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing company, St. Louis, Mo. Application filed August 21, 1899. Original No. 617,114, dated January 3, 1899.

In the motor are combined supporting means, a motor frame, insulation between the means and the motor frame, field magnets, an armature core, induced current-conducting bars in the armature core which are short-circuited on each side of the armature, and fan blades mounted on the armature. (See cut.)

DESIGNS.

31,838. Insulating Plug for Electric Line Supports. Luzerne A. Williams, Syracuse, N. Y. Application filed October 17, 1899. Term of patent, 14 years.

31,839. Coin-controlled Electric-machine Case. William C. Backof, Chicago, Ill. Application filed April 24, 1899. Term of patent, seven years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, DECEMBER 2, 1899. No. 23

Pollak-Virág Telegraph System.

Several tests of the Pollak-Virág rapid automatic-telegraph system were conducted last week between Chicago and other cities, the demonstrations being the first made outside of Budapest, Hungary. In September Mr. C. M. Baker, superintendent of construction for the Postal Telegraph-cable company, was sent over to Budapest, where he witnessed tests of the telegraph system in company with Mr. L. O. McPherson, the electrical expert, formerly associated with Elisha Gray. These tests were of such a satisfactory nature that the Guardian Trust company of Chicago, which had become interested in the invention, decided to have a practical demonstration made of the system's capabilities in this city. Accordingly arrangements were made for the inventors to come to America with their machines. Messrs. Pollak and Virág arrived in Chicago on November 14th in company with Adolph Heerman, Jr., the Hamburg representative of the Guardian Trust company. The instruments were set up in the library of the Chicago Tribune, where connections were made with wires of the Western Union Telegraph company, through the assistance of Mr. J. C. Barclay, electrician for the western division of the Western Union company.

Preliminary tests of the system were made on November 22d and 23d from the Tribune office. A line from Chicago to Milwaukee was first used and later tests were made over wires between Chicago and Cleveland and Chicago and Buffalo. In Fig. 1 is shown a picture of the experimental apparatus set up in the Tribune office, with a group of the gentlemen interested. Mr. Pollak is seen seated at the left of the table and Mr. Virág is standing back of the table at the left. Next to Mr. Virág is Mr. Heerman, and on his left is Mr. Adolph D. Weiner, attorney for Pollak and Virág. Seated at the right is Mr. McPherson, the electrical expert, under whose direct supervision the tests were made.

The Pollak-Virág system is the invention of Mr. Anton Pollak, electrical engineer, and Mr. Josef Virág, of the Royal Hungarian Patent Office of Budapest, Hungary. The advantages claimed are high working speeds on the line wires with very low-voltage currents, a permanent and easily decipherable record and automatic control of the receiver from the sending station. The fundamental idea is automatic transmission from a perforated strip of paper and receiving by photographing the movements of a telephone diaphragm.

In the preparation of the message the paper strip is perforated with two parallel lines of holes, one line representing the dashes and the other the dots of the Continental alphabet. In Fig. 2 (page 322), (P) represents the paper strip; (A) and (A') are two brushes composed of fine wire mounted above a flanged drum or wheel (D) and arranged to press the paper strip firmly against it. The paper strip is moved forward in the direction of the arrow, and, as the line of holes representing the dashes pass under brush (A), for each one there is made an electrical contact between (A) and the drum (D) and current passes from the positive pole of the battery (B) to the line. When a hole representing a dot passes under brush (A') the contact between it and the drum (D) permits the passage of negative current to the line. These impulses are carried to the telephone receiver (T) and the resultant movement of the diaphragm causes a ray of light to vibrate in the following manner: In front of the diaphragm is a small C-shaped permanent magnet (M), one pole of which terminates in a stiff flat spring having a right-angled knife edge at its free end, which is very close to a similar knife edge formed directly on the other pole of the magnet. A very small concave mirror (W) is held magnetically against the two knife edges through the means of a small bit of soft iron glued to its back. A stiff piece of wire is connected rigidly between the telephone diaphragm and the flat spring of (M). It follows that the very slight motion of the diaphragm is transmitted to the spring and the mirror is caused to rock upon the fixed knife edge of the magnet. The light from a small incandescent lamp (L) passes through one limb of the forked tube (Y) and falls upon the mirror (W), from whence it is reflected through the other limb of the tube (Y). A light-proof case (K) is securely joined to the tube (Y). Inside the case (K) is a cylinder (F) carrying a sheet of light-sensitized paper. This cylinder is arranged to rotate around a stationary coarse-pitched screw, so that for each rotation the cylinder moves downward about one-quarter inch. The sending station is given control over the starting of the cylinder (F) by a simple automatic apparatus.

In receiving a message the cylinder (F) is rotated, the beam of light from the mirror (W) dances up and down, leaving its spiral, zigzag, chemical trail to be later developed and fixed as in photography and then translated. A sample of the record made by the receiving instrument, the variations above and below the line corresponding to the dashes and dots, is shown in Fig. 3.

An adjustable self-induction coil (S), Fig. 2, is connected at the transmitter as shown. Its function is to regulate the time duration of the impulses, proportioning them to the resistance and capacity of the line. A condenser (C) shunts the telephone receiver, as shown, for the purpose of damping the self-vibration of the diaphragm. Without this the diaphragm would not come at once to rest after each movement, but would make several short vibrations following each current impulse. The condenser prolongs or "tails off" the impulse so that the current just ceases as the diaphragm reaches the central or neutral position.

The apparatus is quite new and has not yet been put in the best possible form for continuous use;

FIG. 1. POLLAK-VIRÁG TELEGRAPH SYSTEM.—APPARATUS IN POSITION IN CHICAGO.

for instance, the sensitized paper will be used in a continuous band or fillet, and certain other details may be improved upon.

Mr. L. O. McPherson, in speaking of the system and its possibilities, said: "In the tests which I witnessed between Budapest and Berlin over a line 1,050 kilometers (650 miles) long, measuring 3,200 ohms, a speed of 90,000 words an hour with 12 volts' pressure was readily secured. Tests over looped circuits out and back in the Tribune office, Chicago, have shown speeds considerably in excess of this on lines of much greater length. The test signals were sent to Buffalo and back, 1,040

ANTON POLLAK.

miles, with 20 volts positive and 20 volts negative, at the almost incredible speed of 2,400 words a minute, or, putting it another way, there were clearly depicted current impulses at the rate of 36,000 a minute.

"Scientific interest has been aroused throughout the world, and Messrs. Pollak and Virág are in receipt of inquiries for information about their apparatus from almost every civilized country on the globe. The government engineers of Germany have expressed themselves as highly delighted with the invention, and are now considering its formal adoption in the post-telegraph system. The French government sent a representative engineer to witness the tests between Budapest and Berlin on September 25th to 29th, and since Messrs. Pollak and Virág's arrival in the United States they have received a formal request from the French government to give an early exposition of the working of the apparatus in Paris.

"The United States is a graveyard for automatic telegraph systems, as the history of our telegraphs

JOSEF VIRÁG.

and records of the Patent Office will show; and whether this one will follow the general rule or not remains to be seen. I am inclined to believe, however, that it possesses distinct merits, which, when fully understood, will warrant its adoption as an adjunct to existing systems of communication, or as a nucleus for a new system on entirely different lines from the existing systems. It would appear, in the light of past experience that its greatest usefulness is in press and newspaper service and 'night-rate' or similar business."

In commercial use it is probable that a tape similar to that represented in the diagram, Fig. 2, will be used. At present the tape used in the tests has a continuous row of circular holes in the center and larger holes above and below to represent respectively the dashes and dots. A portion of this tape is represented in Fig. 4, with some of the letters of the Continental telegraph code, which has been used thus far in the test.

On Friday evening, November 24th, Messrs. Virág and McPherson took a transmitting instrument to New York. This instrument was set up in the office of the New York World, and a test over a Western Union circuit was arranged between New York and Chicago, the receiving instrument being in the Tribune office in this city. On Sunday, when it was proposed to give a public exhibition of the invention, a number of engineers and technical men were present to witness the test. Owing to an inexplicable accident, however, just as the message was started from the New York end it blurred and then stopped. Demonstrations over short lines

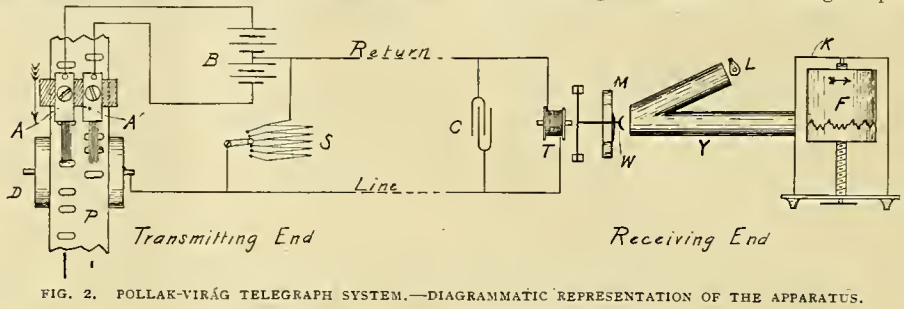


FIG. 2. POLLAK-VIRÁG TELEGRAPH SYSTEM.—DIAGRAMMATIC REPRESENTATION OF THE APPARATUS.

were then given by Mr. Pollak which clearly showed the rapidity at which the machine could operate. However, it is expected that a successful test will be made over the New York and Chicago line. After this has been accomplished the instruments will be exchanged and a Chicago-New York test will be made, the receiving instrument being placed in the World office in New York. Among those attending the tests on Sunday were the following-named gentlemen: Charles J. Glidden, Lowell, Mass., president of the Erie Telephone company; Augustine Knowles, electrical engineer, New Long-distance Telephone company, Indianapolis, Ind.; W. W. Ryder, superintendent of telegraph, Chicago, Burlington and Quincy railroad; C. M. Baker, superintendent of construction, Postal

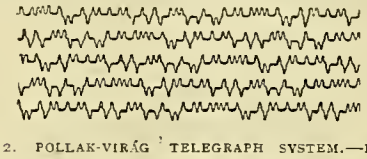


FIG. 2. POLLAK-VIRÁG TELEGRAPH SYSTEM.—PHOTOGRAPHIC RECORD AT RECEIVING END.

Telegraph company; Edward J. Nally, assistant general superintendent, Postal Telegraph company; Alexander Nuber, Austro-Hungarian consul; Professor C. E. Freeman, Armour Institute, Chicago; Professor A. A. Veblen, State University of Iowa; George M. Dugan, superintendent of telegraph, Illinois Central railroad; C. F. Annett, assistant superintendent telegraph, Illinois Central railroad; S. G. McMeen, Central Union Telephone company; E. M. Jackson, Central Union Telephone company; J. C. Barclay, electrician, Western Union Telegraph company; William T. Blaine, president Victor Telephone Manufacturing company; Adolph D. Weiner, attorney.

It is asserted that should the tests prove satisfactory to the stockholders of the Guardian Trust company a new company will be organized to exploit the invention in this country. The inventors' compensation for the American rights, in such case, is said to be fixed at about $3,000,000—half stock and half cash.

River Cable Laid by a Locomotive.

A novel method of laying a river cable was put into execution on November 21st in New York, when an old fire-alarm cable which connected Randall's and Ward's Islands with The Bronx across the Bronx Kills had to be replaced by a new one. The distance between Randall's Island and The Bronx is 600 feet. The new cable, which weighs nearly three tons, says the New York Sun, was stretched out across Randall's Island. One thousand feet of one and one-half inch rope was fastened to the end and a big Harlem railroad freight locomotive which stood ready on the tracks running across St. Ann's avenue took one end of the rope which passed over a strong block. The engine moved along the railroad tracks, pulling the rope and cable after it. It took but 11½ minutes to complete the work, a feat which by the usual method could not have been performed in much less than a day.

Design of Fusible Cut-outs.[1]

By B. H. Glover.

The simplest and therefore most common method of protecting electrical circuits is by means of the fusible cut-out. While much might be said about circuit-breakers, switches and special combinations for opening and controlling circuits, the object of this paper is not to enter into a discussion of the relative merits or proper adaptation of these fittings, but simply to put before you some facts, demonstrated by exhaustive tests and extended practice, and from this information and experience derive a few conclusions regarding the proper design of fusible cut-outs.

That the present cut-outs are not entirely satisfactory goes without saying. If they were the subject of this paper would not have been suggested.

It is a strange characteristic of this age of progress that sometimes the most common and necessary articles are accepted in the crude and often unfinished form in which they were first made, and have been apparently forgotten and neglected in the mad rush for something new or strange. The return swing of the pendulum is, however, inevitable, and we now hear of new forms of arc lamps and renewed interest in the perfection of various forms of lamps depending on the incandescence of heated conductors or metallic oxides.

The thermal cut-out is still one of the most unreliable of the many devices employed on electric circuits. Its use is universal, but beyond a few practical details the device is but little understood. Such improvement as has been made has largely been due to the vigilance of the various insurance boards. As a source of vexation and uncertainty the fusible cut-out is probably unrivaled.

Speaking from the standpoint of the fire underwriter, the proper design of cut-outs is an important subject, inasmuch as a very considerable fire waste has been and continues to be occasioned through the faulty construction and design of these fittings.

All tests and treatments have shown the common cut-out to be subject to such variations and modifying influences that but little of practical value can be deduced from analytical investigations.

A cut-out may be said to consist of three principal parts: (a) the base and its cover, (b) the terminals and (c) the fuse. These will be taken up in the order given, as far as is possible.

(a) In the earlier days of electric lighting wooden bases were used, but were soon abandoned, due to continual trouble with "grounds" and "shorts," resulting from absorption of moisture and the loosening of contacts and charring, due to the combustibility of the wood. Porcelain is now almost universally used. The base and cover being much the larger portion of a cut-out, the porcelain manufacturer has taken it upon himself to design and sell these goods. Important electrical details are often sacrificed for convenience in getting out the porcelain, and "Any old thing will go" seems to be the motto followed in some cases, no regard being paid to the various and excessive demands made upon the product.

It is poor practice to use short fuses in order to economize in porcelain.

The quality of porcelain used and its glazing is seldom given any consideration by contractors or engineers, except perhaps for use with very high potentials.

The subject of glazed and unglazed porcelain in itself opens up a large field for discussion. A glaze with an excessive coefficient of expansion will, in time, become full of cracks or become "crazed," as the porcelain manufacturers express it. These cracks retain moisture and offer paths of comparatively low resistance between terminals of opposite polarity or to ground.

The use of lead in the glaze usually results in a metallic film upon the blowing of a fuse. The parts of a cut-out about the fuse itself should preferably be left unglazed. The fuse should not be in contact with any surface of the base. If supports

FIG. 4. POLLAK-VIRÁG TELEGRAPH SYSTEM.—TAPE AT TRANSMITTING END SHOWING DASHES AND DOTS.

1. Read before the Chicago Electrical association, November 17, 1899. Mr. Glover is connected with the Underwriters' Electrical Bureau.

between the terminals are necessary, they should be in the form of traverse ribs, with smooth rounded tops.

While an air space is desirable about the fuse, the ends of the block should not be left entirely open. As a fuse usually ruptures at or near the center, the aim should be to provide a proper vent at this point and still retain sufficient pressure to cause a blow-out of the metallic vapors and suppression of the arc formed. For these reasons a rather restricted air space at the ends and an enlarged air chamber with vents near the center of the fuse gives more reliable action. A cover for the base should always be used. The fire risk is made less and the sensitiveness of the fuse is thereby increased, especially for small fuses.

(b) The terminals are universally made of brass in the form of stampings, castings or sections of square or round bar. The following modes of connection to the wires have been noted: A screw and washer; a screw with one upturned lug on terminal, with and without washers; a set-screw; two set-screws; an angular bottom piece, with a clip above held by one or two screws; double clips, with a center V-groove. And there are several other methods of connection.

In the construction of switches it is considered quite proper and necessary to provide lugs, firmly bolted or screwed to the switch into which the conducting wires shall be soldered. This applies to switches of over 25 amperes' capacity. If this construction is correct for switches and bus-bars and in making connections to dynamos and motors, why not for cut-outs?

Connections for currents up to 25 amperes should be made to terminals provided with screws and washers, with a turned-up lug on both sides, to prevent this wire from slipping out. When the capacity of the cut-out exceeds 25 amperes, connections should be made with lugs, firmly screwed to the terminals on a flat surface, and into which the conducting wires can be soldered. This may seem like excessive care, but when it is considered that very appreciable losses are due to the many poor contacts and connections made in a circuit, too much attention cannot be given to this matter of contacts. The terminals should be set in from the ends of the blocks, so that live portions of the circuit will not be exposed.

The proper distance between terminals has long been a disputed question. A catalogue of a well-known manufacturer of these goods shows, for 110-volt circuits, break distances of from one-fourth to 2½ inches. This maker no doubt strikes an average somewhere. An engineer of a prominent company stated two years ago: "We are redesigning our link cut-outs, so that the fuse-metal tips shall be fully one inch apart. Some of our cut-outs are much less than this, and we believe it is safer to have a longer break distance than that we are now using." A Chicago engineer whom you all know said a few years ago: "I have always felt that the emphasis of experimental evidence should be directed to convincing the people of the advisability of using long fuse blocks, thereby contributing to the reliability of such protecting devices."

This is all reliable testimony, and should be given careful consideration, not only by manufacturers, but by contractors and engineers as well.

There are many goods on the market with a one-half-inch break distance between terminals. A current of 20 amperes will invariably establish a vicious arc between terminals at this distance, and the terminals will frequently melt with explosive violence. The terminals are not only fused, but often the entire base and cover are shattered into fragments. Such results are aggravated by the enormous capacity of our modern stations in populated districts.

For a given fuse, blown in a given time, there is a critical length. Careful experiments have shown these lengths to be as follows: For three to five amperes, 2½ inches; for 10 to 15 amperes, 3½ inches; for 20 amperes, four inches; or, for each five amperes an increase in length of one-half inch. These lengths seem excessive when judged by common practice, but the data clearly indicate where practice might be improved.

Realizing that extended reforms cannot be instituted at once, the rules of the National Electrical Code specify 1¼-inch break distance between terminals for 110 volts and 2½ inches for 220 volts. The fuses are to be held free from contact with the base and provided with tips of hard metal. In the open type of cut-out the terminals usually have a greater distance between them than in the covered style, but a serious fault in their design is that the terminals are set in flush with the surface of the porcelain. Terminals should be secured to the base by at least two screws, so as to prevent turning and loosening. Screw heads on the back should be countersunk and the heads covered with a moisture-proof and insulating wax or compound. These points should go without saying, but an inspection of stock being sold shows that there is neglect along these lines.

(c) The ordinary fuse is made from an alloy, the greater part of which is lead. This alloy is used in the form of wire, wire links or strips. The opening of the circuit is caused by the melting of the fuse. The necessary heat is obtained from the energy developed in the fuse by the current. But the blowing of a fuse is not immediately an electrical act. The current fuses the metal, the cross-section is reduced at some point, due to gravity, unequal expansion or "sweating," the heat intensifies at this point and a globule falls, breaking the circuit and establishing an arc, which soon burns out a length of the fuse. The time required for this action may vary between considerable limits under different conditions. In some cases this fact is an advantage, while in others it might be fatal.

A combination intended to increase the accuracy of operation and to reduce to a minimum the radiation and conduction of heat is found in the enclosed fuse. A fiber tube is filled with a porous powder and the fuse is soldered to the brass ends of the tube, being embedded in the powder, except in the center of the tube, where a small capsule forms an air chamber. These fuses will operate at a predetermined point for any overload, and can be relied upon within very close limits. An objection has been made to their use, as there is no exterior indication to show when a fuse has opened. A new design is about to be put on the market, with the object of overcoming this objection. It consists of an enclosed fuse, with a shunt of fine high-resistance wire between the terminals on the outside of the fiber tube. The blowing of the fuse diverts the current through the shunt wire, which immediately blows and serves as an outside indicator. Enclosed fuses without the air chamber are not as sensitive or reliable as those with the air chamber.

An ideal fuse would be one that would act at nearly a constant time interval for all currents in excess of its normal. In this respect it would resemble a magnetic cut-out. Its curves would be a straight line from the point of its rated capacity and slightly approaching the vertical axis for all excess currents. In practice the curves of all thermal cut-outs must be more or less modified hyperbolas. The ideal curve could only be obtained were it possible to eliminate conduction and radiation losses. This line of attack should be followed in designing a sensitive fusible cut-out. Small fuses approach this condition to a greater extent than large ones. For sudden, heavy overloads a multiple fuse of several small wires is much more sensitive than one large one of the same capacity. For the same reason a thin, flat ribbon may be considered more reliable than a round fuse.

An issue of $80,000 additional stock by the Lexington and Boston Street Railway company has been approved.

Waterport-Albion Power Transmission.

By Orrin E. Dunlap.

One of the new plants in New York state for the development, transmission and use of electricity is that of the Albion Power company at Waterport and Albion. These villages are located in Orleans County and are 6½ miles apart. Waterport is on the Oak Orchard Creek, at a point where there has been a small development and use of water power many years; in fact, dating back to the year 1830. Several small mills have been operated there, and the place attracted the attention of the men interested in the Albion Power company as a desirable point at which to establish a generating station from which electric current for various purposes might be supplied to the village of Albion and the adjoining neighborhood. With this object in view, the Albion Power company was organized with a capital stock of $50,000, divided into 500 shares of $100 each. The president of the company is Hon. Frank A. Dudley of Niagara Falls. The other officers are: Vice-president, George F. Lum of Waterport; secretary, Sanford T. Church of Albion; treasurer, Raymond D. Johnson of Buffalo; chief engineer and general manager, Wallace C. Johnson of Niagara Falls.

Fig. 1. Dam and Generating Station at Waterport.
Fig. 2. Power Plant at Waterport.
WATERPORT-ALBION POWER TRANSMISSION.

President Dudley was the former law partner of Hon. W. Caryl Ely of International Traction company fame, and it was he that organized the company under the transportation corporations law of New York state. The company is authorized to use and sell electricity for light, heat and power in the towns of Carlton, Gaines and Albion in the county of Orleans. Preparatory to the erection of its dam and power station the Albion Power company acquired, by proper deeds of conveyance, the Lum mill property at Waterport, together with six other tracts of land adjacent thereto, with the rights to construct a dam at or near the site of the old dam of Oak Orchard Creek. The company also controls all the land on the Oak Orchard and the Otter Creek likely to be flooded by its dam. It also secured tail-race rights and the right to use the waters of the creeks referred to, together with the rights acquired by previous grantees to use the overflow from the Erie Canal. The company acquired, in addition, the electric-light plant in the village of Albion, consisting of a thoroughly

equipped, steam-operated station and a distributing system of about 25 miles, including both arc and incandescent systems.

With these rights secured, the Albion Power company commenced the erection of a dam and power house at Waterport. At this point the banks of Oak Orchard Creek are quite high, and afford excellent dam and storage-reservoir facilities. In Fig. 1 the dam of the company is well illustrated, as are also the generating-station buildings to the left. The weir of the dam is 200 feet long and there is an earth embankment 100 feet long. The height of the dam is 12 feet. Water enough is obtained to develop about 400 horse power under a head of about 18 feet, the remainder of the fall being obtained by means of a tail race 1,000 feet long and extending down Oak Orchard Creek. The dam sets the water back fully three-quarters of a mile, forming a reservoir, from which water can be drawn at times of heavy load and which fills up again at times of light load. The flume is set into the earth embankment, which is protected at the ends by masonry piers. All of the dam above the water is of earth and stone. The flume is built of steel framework, filled with concrete, making a concrete wall two feet thick. Thus the steel frame is designed to hold all the pressure, while the concrete fills in the spaces, making the wall quite tight and the construction most successful.

The generating station at Waterport is a one-story brick building, located back of the earth embankment. In it have been installed two McCormack wheels, built by J. & W. Jolly of Holyoke, Mass. One turbine has a capacity of 250 horse power and the other of 175 horse power. These wheels are set in the open flume on a horizontal shaft and discharge through a quarter turn and draft tube outside of the flume. One Stanley three-phase, alternating-current dynamo, of the inductor type, having a capacity of 150 kilowatts when operated at a speed of 600 revolutions a minute, is wound for a maximum electromotive force of 6,600 volts at full-load current, and generates current at 7,200 alternations. There is also a similar dynamo of 100-kilowatt capacity. The larger dynamo is belted to the larger turbine and the smaller dynamo is belted to the smaller wheel. Two six-kilowatt, multipolar exciters, each capable of exciting the fields of the two generators, are used and they are arranged for belt driving from the shaft to the generator. The arrangement of the generating station is shown in Fig. 2, where will also be seen the switchboard designed to control the current at this station. The switchboard is of blue marble. The generators feed directly to the transmission line without the use of transformers, the voltage, as stated, being 6,600.

Between this generating station in Waterport and the sub-station in Albion, which, by the way, is the old electric-light station, the company has erected a transmision line 6½ miles long. This line runs along the highway. The poles are 30 feet high and are set 100 feet apart. On the cross-arms are strung three stranded, pure aluminum-wire cables, each cable being composed of seven wires. This cable was manufactured by the Pittsburg Reduction company especially for the Albion Power company. Triple-petticoated glass insulators, on porcelain-base pins, manufactured by F. M. Locke of Victor, N. Y., are used.

In the sub-station in Albion three static transformers, having a total capacity of 200 kilowatts, have been installed. These transformers are of the indoor type, self-ventilating, and are for service without oil. They transform from 6,000 volts, three-phase, to 1,100 volts, three-phase. The company has also installed in the sub-station one 75 horse power, inductor-type dynamo, designed for service as a synchronous motor to operate on 1,100 volts, three-phase, together with one-kilowatt exciter, to excite the fields of the 75 horse power synchronous motor, and one five horse power, three-phase induction motor for service in bringing the synchronous motor up to speed. The switchboard and type of transformer used in this sub-station are pictured in Fig. 3. In addition to the electrical equipment the station is supplied with the steam plant of the old company. The 75 horse power motor is used to drive an 80-arc-light, direct-current Brush arc machine for public lighting. This motor and the arc machine are so arranged that in case of accident to the transmission line or generating station they can be driven by steam power. Thus, the company has a steam relay equal to the capacity of its generators. The electrical equipment is of Stanley make.

The business section of the village of Albion has been laid out in three districts by the company, and in each of these districts there has been installed, on the street, three 300-light transformers, connected in multiple, stepping down to 110 volts. Each district is connected with one leg of the three-phase line. Running around the outskirts of the village there is another three-phase line, from which all power and outside lighting is taken. Electric power is supplied to Morgan & Linson, cold-storage-warehouse proprietors in Albion, and the Western House of Refuge receives its lighting service from the company. In Waterport, Dudley & Johnson have organized the Waterport Manufacturing company, and this company will use some of the company's power. The Albion Power company has a five-year contract with the village of Albion for lighting that village.

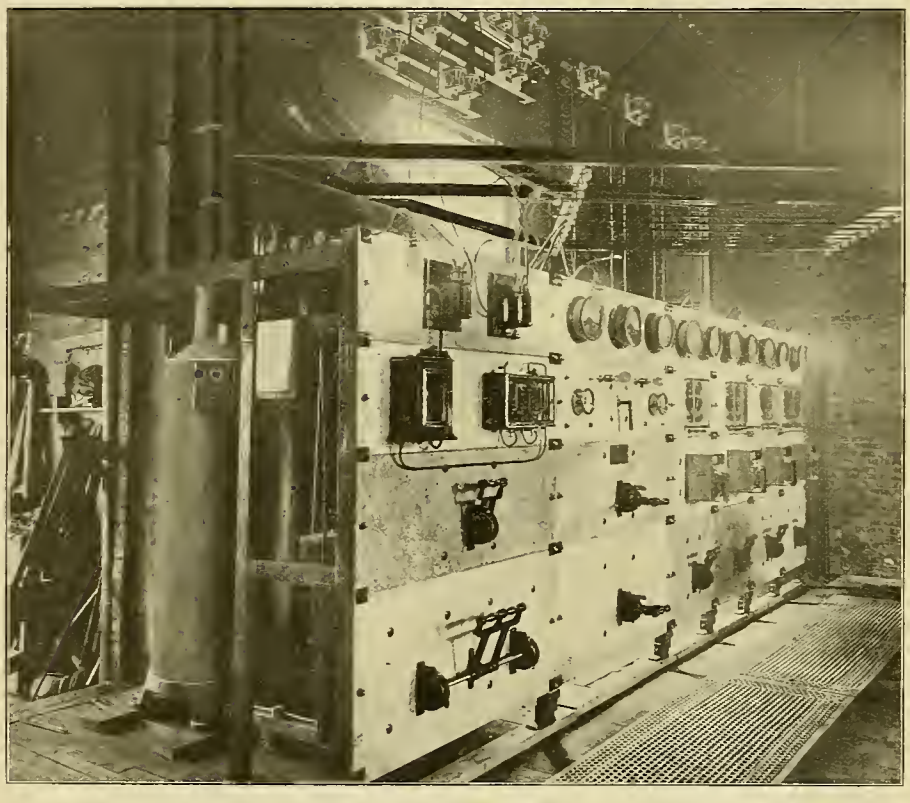


FIG. 3. WATERPORT-ALBION POWER TRANSMISSION.—SWITCHBOARD AND TRANSFORMER AT ALBION SUB-STATION.

Wallace C. Johnson, who is the chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company, and who has had much to do with the successful development of power at Niagara, has had full charge of the preparation and carrying out of the plans of the Albion Power company. The contract for the dam, power house, transmission line and the equipment of the sub-station was awarded to the Niagara Electric company of Niagara Falls, and this company sublet the dam and power house to Crage & Tench of Buffalo.

In what it has accomplished the Albion Power company has clearly shown how small villages, or even large cities, may be benefited by a source of power not too far distant from their boundaries. The people of Albion are alert to the enterprise that has led capital to transmit the power of Waterport to that village, giving it a perfect lighting service at reasonable rates, while also supplying the popular electric power for manufacturing purposes.

Those familiar with the early history of the Niagara Falls Power company will recall that Hon. Frank A. Dudley was instrumental in its development and progress. His ability as an attorney adds to his strength in the lighting and power fields, and time may demonstrate that he has other projects in contemplation.

American Institute of Electrical Engineers.

The western branch of the American Institute of Electrical Engineers held a meeting on the evening of November 22d, at the Technical Club, Chicago. About 60 persons were in attendance. Mr. R. H. Pierce, local honorary secretary of the Institute, called the meeting to order and introduced Mr. A. V. Abbott, who gave an interesting and instructive address on space telegraphy. Transmitting and receiving stations were fitted up in opposite corners of the room and practical demonstrations of the system were given. Stereopticon views showing tables and data, the action of the filings in a coherer under the influence of the etheric waves, diagrams of connections, etc., were used by Mr. Abbott to supplement his remarks. A vote of thanks was extended by the Institute to Mr. Abbott for his valuable talk.

A paper on "Test of a 300-kilowatt Direct-connected Railway Unit at Different Loads," by Edward J. Willis, M. E., was read by title by George A. Damon. The paper by William L. Robb on "Series Arc Lighting from Constant-current Transformers," which was read before the Institute at New York, on September 27th, and published in the Western Electrician of October 14th, was also read by title by James Lyman. As an exhaustive discussion of the paper is being prepared by a member of the Institute, the full reading of the paper and its discussion were postponed to a future meeting.

At the New York meeting on the same evening Mr. Willis' paper, in the absence of the author, was read by Mr. George F. Sever. It was discussed by Messrs. Hill, Mailloux and Sever. The subject of "Possibilities of Wireless Telegraphy" was then taken up, the discussion being opened by Prof. R. A. Fessenden of the University of Western Pennsylvania and continued by W. J. Clarke, M. I. Pupin and others.

At the meeting of the council in the afternoon in New York the following-named associate members were elected: E. C. Baugher, New York, N. Y.; Frank George Baum, San Francisco; Louis W. Downes, Providence, R. I.; Clifton V. Edwards, New York, N. Y.; George H. Gibson, New York, N. Y.; Louis T. Grant, Hilo, H. I.; Arthur James Hanson, Sydney, N. S. W.; Martin J. Insull, New York, N. Y.; E. D. Jackson, Youngstown, O.; W. A. Layman, St. Louis, Mo.; John Lundie, New York city; Charles William PenDell, Boston, Mass.; Charles B. Raub, Newport, R. I.; Allen Davidson Roberts, Kingston, Jamaica; H. A. Russell, San Francisco, Cal.; Ferdinand Schwedtmann, St. Louis, Mo.; Hewlett Scudder, Jr., New York city; Joseph Suydam Stout, Jr., New York city; Clinton Eugene Whitney, New York city; C. M. Wilkes, Chicago, Ill. The following-named associate members were transferred to full membership: Cummings C. Chesney, Pitsfield, Mass.; Capt. Achilles de Khotinsky, Madison, Wis.

Metallo-ceramic Resistances.

According to l'Electrochimie, Messrs. Parvillée have succeeded in obtaining remarkable results in the line of very high resistances in limited compass. These resistances are capable of withstanding high temperatures in the open air. The inventors have named them metallo-ceramic resistances, from the elements combined in them, which are powdered metals and an insulating paste, such as kaolin. The metal thus introduced into the mass is more or less a conductor in proportion to quantity, and it is thus easy to obtain any desired resistance.

The metal preferred for this purpose is nickel, because of its high fusing point. The pulverized metal is incorporated in the refractory paste; the mass is subjected to high pressure, and is afterward baked like chinaware. It thus acquires great firmness and solidity, and may afterward be heated to white heat without altering its electrical properties, and it will retain its integrity with no appreciable change in resistance. These resistances may be thus heated in the open air to very high temperatures, and then permitted to dissipate their absorbed caloric in a more confined space. Thus, with three rods having a length of 16 centimeters, a width of 1.5 centimeters and a thickness of 0.4 centimeter, 25 amperes of current at 110 volts, or 2,750 watts, will generate 2,400 calories an hour.

The metallo-ceramic rods are copper tipped, and in order to prevent oxidation at the junction through heat, the conductivity of the rods is gradually increased from the center toward the extremities. As a result the extremities do not heat destructively.

A single instance of the resistance is given: A rod 0.5 centimeter long, 0.1 broad and 0.3 thick showed an ohmic resistance of 100 ohms, a specific resistance 500,000 times greater than that of the pure metal.

The Boston Elevated Railway company has been granted a permit to rebuild on the site of the car houses destroyed by fire recently in Cambridge. The new structure will cost $60,000.

Electric-lighting Plant in Columbus, Wis.

It is a pleasing evidence of progress that many of the newer electric-lighting plants in villages and small towns are now as carefully planned and substantially built, proportionately, as the pretentious systems of the great cities. Fireproof power houses, modern machinery and well-constructed pole lines—the whole well kept and carefully operated—are to be found in many communities of less than 5,000 inhabitants. The hurried, slovenly construction of the early days is passing away, and there will be no mourners when the last reminder of it is relegated to the scrap-heap.

FIG. 1. ELECTRIC LIGHTING PLANT IN COLUMBUS, WIS.—GENERATING UNITS.

A couple of months ago the Western Electrician described a well-built, modern central station in Edwardsville, Ill., a town of 4,000 people, and this week it illustrates an up-to-date installation in Columbus, Wis., a pleasant little city of 3,000 inhabitants. This plant is a municipal one, and not a private enterprise, but it seems to be all right in every other respect.

Columbus is situated in a prosperous and fertile farming country, and its residents are well-to-do and very proud of its prettily shaded streets and general air of comfort and even elegance. But up to last midsummer it was considered a little behind the times, as it had no electric-light plant. The reasons assigned for this are that the city fathers considered that improvements in other channels were of more importance. But at that time contracts were entered into for a tasteful city hall, which was built at a cost of about $17,000. Later on an excellent water system was installed at an expense of $25,000. Showing unusual forethought, the council built the pumping station large enough to contain engines and dynamos for a forthcoming electric-light plant.

FIG. 2. ELECTRIC LIGHTING PLANT IN COLUMBUS, WIS.—OVERHEAD CIRCUITS LEAVING POWER HOUSE.

In July last Mr. Frederick Howe Ford, electrical engineer of Madison, was retained to furnish plans and specifications for an up-to-date lighting plant. After due consideration and consultation a 220-volt, direct-current system was adopted. Bids were called for and contracts awarded for the different divisions as follows: Engines, A. L. Ide & Sons; dynamos, Westinghouse Electric and Manufacturing company; arc lamps, "Bergmann," Martin J. Insull company, Chicago; switchboard and pole line, Electrical Supply company, Madison, Wis.

The plant was installed and the arc lamps lighted for the first time on September 19th, at the opening of the annual "street fair," for which Columbus is noted. On the evening of that day everything was arranged for a little surprise for the public, which was under the impression that it would have no arc lights for the fair. But at the time for starting the light, a band, which was stationed on a platform in the center of the main square, at a given signal struck up "There'll Be a Hot Time in the Old Town To-night," and simultaneously the arc lamps hanging over the heads of the people, heretofore dark and inert, sprang into light and flashed their brilliant illumination over the surprised merry-makers. The people shouted and applauded at the sight. It was a happy moment and everyone was delighted.

The city officials, the people and the contractors are satisfied that the plant is modern, well built and efficient. It consists of two horizontal, single-cylinder, non-condensing, high-speed, automatic cut-off engines, especially adapted for direct connection, capable of developing 65 brake horse power at 300 revolutions per minute, with 80 pounds initial steam pressure and cutting off at quarter stroke. Steam is taken from the boilers of the pumping station. The engines, of the well-known Ideal type, are direct-connected, with one sub-base in each instance, to two direct-current, constant-potential, multipolar, compound-wound generators of 170 amperes' capacity at 245 volts. The dynamos are of the Westinghouse make. The two units (Fig. 1), situated at either end of the engine room, are connected by a large cable acting as an equalizer.

The switchboard is made of Italian marble, has two sets of Weston instruments mounted thereon, also an automatic circuit-breaker for each generator, besides other switches and accessories.

The arc lights are the familiar Bergmann lamps and are known as the 100-hour, long-burning, enclosed type. They burn two in series and are very steady and give forth a fine light.

The pole line (Figs. 2 and 3) is without doubt one of the best constructed in the state. The poles are all 30, 35 and 40 feet high and are painted white and black. Long-leaf yellow-pine cross-arms are used, and wires of sizes from No. 000 to No. 10 were strung thereon in workmanlike manner. Special attention was given to heavy guying, to keep the poles erect and in line. Many compliments have been given the contractors for the pole line, which has a neat and substantial appearance. Thirty-six lightning arresters are placed at the proper places to protect the line.

Citizens of Columbus are enthusiastic over the new enterprise and are only sorry that their orders for incandescent lights are not filled more promptly. Some of the residences will be very artistically lighted, with ornamental fixtures. The council did an unusual thing in passing a formal resolution acknowledging its appreciation of the manner in which the Electrical Supply company had fulfilled its contract with the city. The council was especially gratified, it is said, with the pleasant business relations which it had sustained with President Burch of that company during the fulfillment of the contract.

FIG. 3. ELECTRIC LIGHTING PLANT IN COLUMBUS, WIS.—POLE LINE; POWER HOUSE IN DISTANCE.

A Curious Accident.

A passenger on a street car in Dublin desiring to alight asked the conductor to stop the car, and was told to pull the bell cord himself. By mistake the passenger pulled the trolley cord and in such manner that a connection was made with other wires, which were melted. The several ends dangled down among the passengers seated on the roof of the car, shocking several of them into insensibility. The passenger was arrested, charged with meddling with the wires. The justice held that the company was alone culpable and discharged the prisoner. This decision will probably put the company on the defense in the cases of the passengers who received shocks from the damaged conductors, and the conductor will seek other employment.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

510 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year: single copies, 10 cents. When change of address is requested, the **old address** as well as the new, should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Some interesting statistics were secured by a canvass by the Michigan railroad commissioners of the employes of 19 street-railway systems of the state. The number of employes canvassed is 1,021, an average of 54 for each road. The average age of employes is 33½ years. Of the whole number enumerated 754, or about 74 per cent., are native-born. The canvass as to the social conditions of the employes shows that 752 are married, 245 single and 24 widowed. Of the married men, 575, or 76 per cent., have children numbering 1,620. The number of persons depending upon the employes for support is 3,192, an average of about three. The 1,021 employes have worked at their employment an average of five years each and they receive an average of $1.72 a day. The average daily wages paid to different classes are as follows: Superintendents, $2.48; assistant superintendents, $2.05; foremen, $1.83; engineers, $2.25; assistant engineers, $1.25; machinists, $1.83; firemen, $1.96; motor inspectors, $1.94; electricians, $2.08; carpenters, $1.79; blacksmiths, $1.83; painters, $1.50; linemen, $1.32; conductors, $1.76; motormen, $1.72; trackmen, $1.32; barnmen, $1.45. Eight per cent. of the employes assert that the work is dangerous to their health. The figures show that 85 per cent. of the men work by the hour, their wages averaging 18 cents an hour. Only four per cent. report an increase in wages during the year, but nearly 50 per cent. report that they can save something from their wages. Twenty per cent. of the men own their own homes.

Mr. McPherson states a truth in a striking way when he says that "The United States is a graveyard for automatic-telegraph systems," as he does in an interview given in the article on the Pollak-Virág system of telegraphy, printed on another page. The Wheatstone and other automatic systems have been found useful to a limited extent only, and it seems doubtful whether the new invention—ingenious and interesting as it certainly is—will form an exception to the experience of the past. It introduces a telephone diaphragm and a photographic process into the work of telegraphy and requires a complete metallic circuit. It has not been used with a repeater, and in its present state has not been successfully operated over a greater distance than 700 miles. But the actual speed of transmission is very great—as high as 2,500 words a minute or more—and this, of course, would result in a great saving of wire; the wire capacity of existing telegraphs would be enormously increased. Of course, the labor and speed of perforating the sending tape and of developing and translating the record received must be taken into account, as well as the possibility of securing a volume of suitable business to keep the expensive machines economically employed. Obviously the chief advantage of the Pollak-Virág system is in wire economy, and it may be doubted whether this will offset its limitations. The machine has never been tested under ordinary commercial conditions, we believe, and until that has been done the average electrical man will be disposed to doubt its practical utility.

A case against an electric-light company for damages for injuries resulting from the escape of current which was recently decided by a Connecticut court has some features of unusual interest. A brief reference to the circumstances that brought about the suit was made in the Western Electrician a short time ago. Charles Parks and his wife of Naugatuck were the plaintiffs. They sued the Naugatuck Electric Light company for injuries received by Mrs. Parks from electricity due, as they asserted, to the negligence of the company in insulating its wires. Mrs. Parks stood on the porch of her residence one evening, and her attention was attracted, as it is stated, by the peculiar appearance of some shrubbery which seemed to be on fire, glowing with a peculiar light. She walked out to the bushes and grasped a twig. She received a severe shock, and as she felt herself falling she clutched a guy wire supporting an electric-light pole in front of the house. Her hand was burned so deeply, it is said, that she was for a long time unable to perform her household duties, the injury proving to some extent a permanent one. The husband sued the company for the loss of his wife's services and Mrs. Parks brought suit for personal injuries. They both established their case in a trial court, $800 damages being awarded to Mr. Parks and $1,200 to his wife, each to recover costs. The defendant tried to show that all that could be done to make its wires safe had been done and that if there was a leak it was due to no fault of the company or its employes. But the decision was against it, and it is probable that an appeal will be taken to the Supreme Court of the state. The peculiar feature of the case is that the escaping current should have given the shrubbery in contact with the guy wire the appearance of being on fire, as testified by Mrs. Parks. It is conceivable that with a leak on the overhead line the current might have sought the earth through the guy wire, and thus a shock might have been felt by touching the branches of the bush, especially if they were wet. But it is not so easy to account for the statement that the bushes glowed with light and seemed to be on fire. The frisky current should have been content to seek the ground unobtrusively by way of the friendly guy wire without indulging in a pyrotechnic performance in the shrubbery.

Congress will probably be asked to make a special appropriation to carry into effect the recommendation of the board of naval officers that approved an extended trial in actual service of Marconi's wireless-telegraph system, after the recent tests on the New York and Massachusetts. The members of the naval board were satisfied that the inventor will find means to overcome the deficiencies in the apparatus. Even in its present condition the system is thought to be of sufficient value to warrant the considerable expenditure which is stipulated in Marconi's proposition to the naval authorities. The inventor wishes the navy to install not less than 20 sets of apparatus on various ships at an expense of $500 for each set and an annual rental of $500 for each set. Thus the expense would be $20,000 for the first year and $10,000 a year thereafter. Mr. Marconi promises to give to the navy the benefit of all improvements he may make and to replace the instruments by later patterns as often as may be necessary for their more efficient operation, but the navy will have to pay for all repairs and meet the actual cost of such changes as may be made. A contract of this sort smacks rather unpleasantly of the royalty plan of renting instruments adopted by the American Bell Telephone company, and no doubt Congress would prefer to buy the instruments outright, even at a higher price. But as Marconi is the man who has brought space telegraphy to pass over considerable distances, the lawmakers may be willing to accede to his terms rather than lose the undeniable benefits of his invention.

It seems that in the agitation produced by the invasion of the English market by American machinery the British expositor can take no moderate middle ground in "sizing up" the achievements of his Yankee rivals. He either lauds the methods of his formidable competitor to the skies or else attempts to discredit him by mere ridicule or abuse. In the latter classification appears to belong the following quotation from an English electrical journal: "Successful American competition has been due, as all of us know, to reducing men almost to the level of machines. The life of a machinist is one grinding monotony, and cannot even be tolerated at the present long American hours. Such workers, no matter how well paid, cannot ever remain good, intellectual citizens. They must either degenerate or have greater leisure.". Of course, this is absurdly overdrawn, so far as it assumes to be an accurate statement of existing conditions. The cocksure statement of what "all of us know" will excite a smile.

On the other hand, there are not wanting those among the English writers on the subject who go to extravagant lengths in praising American workmen, shop methods and time-saving devices. This tendency has been noted in a sensible editorial in the American Machinist, in which the fact is pointed out that in many manufacturing establishments in the United States the men and equipment do not even approximate the ideal requirements. "Our foreign friends," says our contemporary, "when they visit us, naturally see our best shops, and when they or American writers speak of our shops they naturally have in mind our best ones only. But we have all kinds of shops here—some that we will guarantee are operated upon as narrow-minded and unprogressive principles as are to be found anywhere else in the world."

In truth, American workmen are far above the level of machines, while still considerably below the estate of perfect men. Their employers are neither pure philanthropists nor heartless taskmasters utterly devoid of the milk of human kindness. Both are seeking to advance their own interests, but, on the whole, they probably work together better than similarly placed men of other nationalities because they have a mutual pride in the national ingenuity and a clear realization of their interdependence.

Activity in the Electrical Field in Australia.

By C. Paulo Rei.

The installation of electric-light plants and the construction of electric tramways are the order of the day in New South Wales, Victoria, Queensland and South and West Australia, but New South Wales is more advanced in this respect than any of the other colonies. At the first meeting of the new session of the Electrical Association of New South Wales, held in its new rooms in Sydney last spring, the president, Mr. A. C. F. Webb, M. f. E. E., delivered an address in which he briefly outlined the position of electrical work in the colony, and some of the remarks and statistics used by Mr. Webb in his address are herein quoted.

In all there are 16 electrical plants at present in New South Wales, supplying outside consumers with light and power, six of which are under the direction of the municipal authorities, and the remainder in the hands of companies or private individuals. Sydney and its suburbs contain eight, and eight are in the country, at Moss Cale, Penrith, Young, Lambton, Newcastle, Tamworth, Hillgrove and Broken Hill. Contracts for erecting another power house and the installation of machinery and electric lights have been given out. This new plant is at Paramatta and its principal use will be in lighting the jail there. The plant, exclusive of the power house, will cost $23,875.

Outside of the 16 supply stations mentioned there are in the colony, as near as can be ascertained, about 70 isolated electric-light plants, aggregating more than 1,500 horse power, with an equivalent of about 31,000 eight candle power lamps connected thereto.

For some time back discussion has been going on in the Sydney municipal council as to the advisability of erecting a municipal-light plant, but beyond the formation of a committee to take evidence, no progress has been made, and on this subject Mr. Webb had the following to say:

"It is worthy of note that since the Sydney council's electric-lighting act was passed three new central electric-supply stations have been erected within the city boundaries, and are now supplying an equivalent of 11,000 eight candle power lamps with a total ultimate capacity of 412 kilowatts. The five central stations previously in existence can account for additional consumers to the extent of at least 4,000 eight candle power lamps, and new isolated plants for another 1,000, or a total of 15,000 eight candle power lamps which might have been connected to the council's mains and which now means so much loss of possible revenue and increased cost of compensation if the Sydney council does as the Melbourne council found it necessary to do, i. e., buy out their rivals." This is a good illustration of the general use to which the good citizens of Sydney are putting the invention of Edison, an increase during a few months of 15,000 eight candle power lamps, within the city limits. One of the new central-supply stations referred to by Mr. Webb was opened on March 1st. This is the Oxford electric-light station, and it was installed by the Brush Electrical Engineering company for H. Langer & Co. in Oxford street. Messrs. Langer & Co. have been supplying electric light to a number of stores in the neighborhood for some months, and have met with so much success that they decided to increase their plant in order to cope with the increasing demands made on them for light. The machinery, which is of a modern and up-to-date description, works with great smoothness and efficiency. The plant includes two steam dynamos, each having a Brush Universal compound tandem steam engine (high pressure cylinder, 10¾ inches diameter; low-pressure cylinder, 16 inches diameter, with 6¾-inch stroke), capable of developing 60 indicated horse power at a steam pressure of 130 pounds and a speed of 420 revolutions per minute. The engines are each direct-coupled to a Brush Universal two-pole shunt-wound dynamo, with an electrical output of 36,000 watts at a pressure of 220 volts, or an equivalent to 1,300 incandescent lamps of eight candle power each, making a total output for the plant of 2,600 lamps of eight candle power each.

Of the electrical output of the colony, but a very small portion is utilized for motive power, the number of electric motors being not more than 36 (exclusive of tramway work and fan motors), and the aggregate horse power but slightly exceeding 170. However, the tendency to utilize electric motors appears to be steadily growing. The Sydney water and sewerage board has, during the last 12 months, adopted electric motors in connection with its low-level sewerage pumps.

In mining electric power has also commenced to be employed, the Sunlight Gold Mining company having installed electric motors for hoisting and ventilating, while the Lithgow and Clifton collieries have each put in an electric-pumping plant. The Co-operative colliery at Newcastle has had an electric pump working satisfactorily for many years, and for a long time was unique in this respect.

As supply stations become more numerous and larger throughout the colony, electric motors will no doubt be used more and more in providing power for the various industrial establishments that are now employing steam and other power. However, to offset this small use of electric motors, it is to be noted that the electric traction is increasing rapidly, the authorities having recently announced their intention to adopt electric traction on the whole of the Sydney steam service, all of which is government property, and to proceed at once with the work of conversion. Altogether some 40 miles of steam lines will be converted into electric tramways, and the cable system of North Shore will undergo a similar conversion. It is probable that tenders will at once be called for the supply of a large number of electric cars.

In addition to this the railway commissioners and their officers have been making inquiry into the question of extending the Military Road electric tramway to the Spit road, and also of constructing an electric tramway from Manly to Narrabeen. New lines have been opened during the last year as follows: The Willoughby line with three miles, five chains of track, including 52 chains of double line and one loop, and Rose Bay line, with one mile, 23 chains of track, including three loops, or a total extension of five miles of single track, making a total of nine miles, three chains that is now open for traffic in the city. The total number of cars in use is 17, of which number 12 are in use at North Shore and five at Rose Bay, one of the latter being an experimental car.

Among the additional cars at North Shore are five with General Electric equipments. The additions also include new plant as follows: At North Shore one multipolar General Electric generator of 100 kilowatts' capacity, which makes a total installation of three 100-kilowatt multipolar and one 60-kilowatt bipolar generators; a battery of 220 Chloride storage cells, with 340 ampere-hour capacity for a six hours' discharge, and a Parker motor-booster of five kilowatts capacity. The Rose Bay plant consists of two six-pole generators of 150 kilowatts each and a Chloride storage battery of 240 cells of 276 ampere-hour capacity for a six hours' discharge. This plant supplies the power for the pumping station at Double Bay, as well as for traction purposes.

Some interesting experiments are being carried out at the instance of the railway commissioners to determine the value of the salt water of Sydney harbor as a return circuit for current used in electric tramways. If found practicable the intention is to apply the principle in this North Shore system of tramways, so that instead of laying a set of cables under the harbor in the usual form in order to establish a complete metallic circuit, the salt water will be used as a means of conveying the return current to the conductor on the land side. If found feasible, some interesting results in the way of electrolysis may be looked for.

A considerable amount of work has also been accomplished in the construction of the George street electric line, including the laying of the three miles of double track, the erection of the posts for the overhead work, the laying of the underground conduits for the feeders and the drawing in of some of the feeder cables. Fair progress has also been shown in the construction of the power house. A great disappointment to those interested in electrical progress in the colony has been the continued postponement of the much-needed general electric-lighting act, for which a bill was drafted as long ago as 1890. In 1897 deputations from the Electrical Association of New South Wales and the Engineering Association of New South Wales waited on the colonial treasurer with a view of urging the necessity of the introduction of legislation on this important question, and were met with the answer that a bill had already been prepared and would shortly be introduced as a government measure, but so far nothing has been accomplished. In September of 1898 an attempt was made to persuade the postmaster-general, who has charge of the matter, to have the draft bill put down for the forthcoming session as an item of government programme, only to be met again with the news that still another bill was being drafted. Since then the controversy on the federation of the colonies has swamped the question.

That this act is much needed is best shown by the fact that several county municipalities have contemplated joining forces in order to get a bill through for their own particular requirements. With an act already in force, as it should be, all that would be necessary would be for each of these various municipalities to make application in the ordinary way for provisional orders.

The first electric crane in Australia was lately put to work at the Ultimo power house in Sydney. The crane is capable of lifting about 30 tons.

In the numerous ferry steamers plying in Sydney harbor electric light has almost entirely superseded other systems, and all of the steamers of recent construction are fitted throughout with electric light. Some 23 in all are now electrically illuminated. There certainly can be no comparison between the two forms of lighting, the new and the old, as regards comfort and cleanliness to the passenger, and the electrically lighted boats are invariably distinguished by the brilliancy of their appearance.

The principal electric-supply stations in Sydney at present, with capacity, etc., are as follows:

Name of Station.	No. of 8 C. P. Lamps.	Max. Current.	No. of Consumers.	Capacity.
Strand	6,400	1,910	80	.....
Palace	6,500	1,600	40	225 k. w.
Empire	2,854	230	17	63 k. w.
Redfern	4,559	1,270	100	240 k. w.
Napoleon Street	724	200	7	25.5 k. w.
Oxford	1,533	230	14	72 k. w.
Imperial Arcade	2,872	640	8	75 k. w.

The imports of electrical machinery and supplies from the United States are increasing rapidly, although Great Britain has supplied by far the greater portion so far. Germany also does a considerable trade with the colonies in dynamos and supplies. American machinery is, however, greatly liked, largely due to its compactness and comparatively light weight, and its sale will be large in these colonies during the next few years, if proper attention be paid to the trade.

There are, of course, many contractors and dealers in electrical materials in Sydney, but the principal ones are as follows: Australasian Edison company, Standard Electrical Engineering company, Brush Electrical Engineering company, Crompton company, Holroyds, Wall & Co., Edge & Edge, Clyde Engineering company, Lasseter & Co., Edward Fabris, Charles Highland, Robert Thompson, R. T. Ball.

In Queensland the Townsville Electric company has been organized recently, with a capital of $250,000, and a concession is to be asked for the laying of an electric tramway in Townsville. The superintendent of the company proposes to generate electricity, not only for the maintenance of the tramway, but for other purposes as well.

In Victoria a change is to be made by the Postoffice and Telegraph Department on the telegraph and telephone lines of that colony from wooden to iron poles. On the Northeastern line it has been found from experience that the life of the iron pole is about four times that of the wooden, and the estimated saving by this and the reduced cost of erection and maintenance for a period of 50 years would be in the neighborhood of £350,000. The sum of £15,000 is to be applied from the loan moneys for the purchase of iron poles, and considering the fact that there are about 3,820 miles of telegraph and 618 miles of telephone poles in Victoria, the most of which are of wood, there may be an opening here for American manufacturers of iron poles. The telegraph engineer in Melbourne, Mr. G. Smibert, can be addressed on this subject.

In the towns of Hawthorne, Victoria, Perth and Boulder City, West Australia, municipal electric-lighting schemes are being considered.

In Adelaide, South Australia, electric tramways are spoken of as a possibility. The ministerial programme, it is affirmed on good authority, will include as a leading feature the purchase of the present horse tramway run by different companies and the substitution of electricity as a motive power. A central tram terminus in connection with the alterations now in progress at the North Terrace railway station forms part of the scheme as sketched. The tramway act of 1884 provides that at any time after 14 years, or at any period of seven years thereafter, the government may buy the tramways at a price fixed by arbitration.

Although the first electric installation in Australia was made some years ago, it may be said that only within the last 18 months has any real progress been made; but now that the progressive citizens of New South Wales and Victoria have come to a realization of the superiority of electric lighting, traction and power for industrial purposes over other systems, developments in the electrical field in these colonies (and the other colonies will not be far behind) will be rapid.

Already in Sydney and Melbourne there is a dearth of competent electrical engineers, and it is said that good salaries are paid to those now in the field.

Power Transmission in New Hampshire.

The Manchester Electric company has just acquired the water power and 1,000 acres of land at Garvin's Falls, 15 miles north of Manchester, N. H., and will erect at once a modern first-class fireproof power house and transmit 10,000 horse power to the city of Manchester for the general light, power and street-railway business which the company controls.

This water power is the largest in the state, except the Amoskeag Mills' plant, and will rank among the finest in New England. It has been only partially utilized for many years.

The old Garvin's Falls Power company will still do business under its original name and charter, although owned by the Manchester Electric company. J. Brodie Smith is superintendent of both companies, and S. Reed Anthony and Nathan Anthony of Boston are respectively president and treasurer of the Garvin's Falls company.

The new owner will offer inducements for industries to locate on its land at the falls, and also supply light and power in the villages between Concord and Manchester, but no contracts will be made at Concord, the Sewall's Falls plant having exclusive rights in that city. C.

Railway Signaling Club.

At the meeting of the Railway Signaling Club held at Young's Hotel in Boston recently a number of papers were read on the subject of signals and their operation in the railway service, and the members in attendance visited the new Southern Union station after the meeting, by special invitation, to inspect the complete up-to-date system in use at that terminal. Officers were elected as follows: President, A. M. Kepple, Jr., Pennsylvania railroad, Pittsburg, Pa.; vice-president, C. C. Rosenburg, Lehigh Valley railroad, South Bethlehem, Pa.; secretary and treasurer, C. O. Tilton, Chicago, Milwaukee and St. Paul railroad, Milwaukee; executive committee, Frank Rhea, Pennsylvania railroad, Pittsburg, Pa., and the other officers.

DEVELOPMENT OF THE TELEPHONE FIELD.

New Ulm Plant, Destroyed by Lightning, Replaced.

Independent telephone men do not readily yield to misfortune, as was shown by the account in the Western Electrician a few weeks ago of the rapid rebuilding of the plant in New Richmond, Wis., after it had been swept away by a cyclone last summer. New Ulm, Minn., furnishes a somewhat similar case. The plant was entirely destroyed by lightning, but was replaced in better shape than before with encouraging promptness.

Five years ago a small telephone exchange was

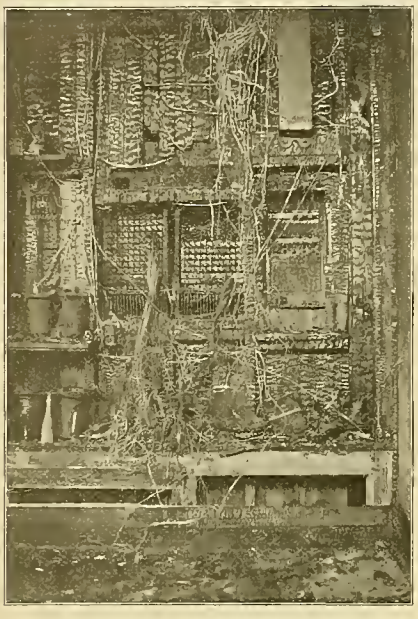


FIG. 1. NEW ULM PLANT DESTROYED BY FIRE.

opened in New Ulm, with 40 subscribers. The owner of the plant, with a laudable ambition, put in apparatus of good quality, with metallic circuits. Six months later the subscribers had nearly doubled in number, and as it was thought advisable to have connection with other towns and cities, a stock company was formed and 50 miles of copper circuit toll lines was built in three different directions.

Very soon after this additional switchboard room and cables had to be installed, and, the location of the exchange also being changed, everything was put in first-class shape. With 150 subscribers the plant was paying well, when in July of this year lightning struck the building in which the exchange was located, and the entire outfit was destroyed. The accompanying picture (Fig. 1) is a reproduction of a photograph showing the charred and wrecked switchboard after the fire resulting from the lightning.

New material was ordered the day following the fire, and plans were made to put in an up-to-date exchange. The switchboard used was made by the

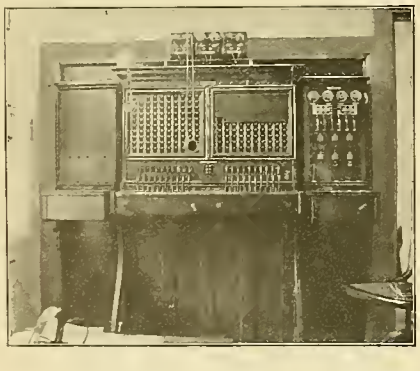


FIG 2. NEW ULM PLANT.—PRESENT SWITCHBOARD.

Western Telephone Construction company. All the cables, four in number, are brought up to the lightning arresters in brass-armored conduits. The lightning arresters are mounted on porcelain, both fuses and carbon blocks being used. From the distributing board the cables to the switchboard are again strung in brass-armored conduits. The floor in the terminal part of the building is made of cement and the side walls are lathed with wire lath. This makes the exchange as near fireproof as anybody could wish to have it. The operating room is neatly arranged, with the local board in the center and one toll board on each side. The toll boards are the company's own manufacture, each drop being supplied with an extension bell, which can be cut out or in by means of knife switches, one side being cut out by the switch and the other by the jack spring. One double-pole, double-throw knife switch enables the operator to use either one of two sets of batteries, and another switch of the same character throws the electric light over the switchboard or over a writing desk near by. The new switchboards are shown in Fig. 2. The company, which is doing very well, is officered by H. L. Saverien as president, C. H. Dirks as secretary and Joseph Bobleter as treasurer. All the stockholders, 10 in number, are local business men.

Independent Telephone Movement in Illinois.[1]

By M. A. King.

That the Independent telephone interests in Illinois have grown to very large proportions is evidenced by the following statistics:

Exchanges	182
Toll stations	730
Miles of toll lines	6,000
Telephones in use	20,000
Capital invested	$1,500,000

Against this the Bell have:

Exchanges	87
Toll stations	720
Telephones in use	14,000

This does not include Chicago's 15,000 telephones.

The Independents and Bell have competing exchanges at 26 points and competing toll stations at 260 points. There are, therefore, 156 towns in Illinois which have Independent exchanges and no Bell, and 470 towns which have Independent toll stations and no Bell. Since January 1st the Central Union has absorbed, by purchase or lease of instruments, 10 Independent Illinois exchanges, with 2,500 telephones, and three toll-line companies, with about 500 miles of toll lines. There may be more. At the present time five Independent exchanges, with 700 telephones, and two toll-line companies, with 285 miles of toll lines, are reported to have made a price to the Central Union on their plants.

The phenomenal growth of Independent interests in all states, as well as in Illinois, has doubtless been the cause of much comment in the last six months. The policy of the Bell people seems to be to bring special pressure of maximum offers to important Independent exchanges holding a central position in any locality, and which also possesses radiating toll lines. By acquiring such an exchange they have possessed themselves of the key to the situation in that territory, and effectually, for the time being at least, checked Independent exchange of business. Of this the Tuscola exchange is an example.

This convention, as well as the local associations now existing in Illinois, is a step in the right direction.

Another way exists of strengthening the Independents, and that is by consolidation of all companies in one county into a strong central organization under one management, whose policy should be reconstruction and extensions. If commanding the proper amount of capital, then the Independent interests in the county become an absolute barrier to other encroachments and their policy becomes one of aggressiveness, instead of, as now, defensive solely.

I note in personal visits to exchanges that in many instances short-sighted policy has been pursued in the first installation, and in consequence 50 per cent. of the exchanges are discarding their first switchboards—having outgrown them—and purchasing new and larger ones.

I think that the following table will be of service to all companies contemplating purchasing switchboards. If the figures are in error, the mistake will be on the side of safety, and therefore no detriment.

The ultimate capacity of a switchboard should be, in towns of

5,000 population or less	1 drop to each 8 population
5,000 to 10,000	1 drop to each 10 population
10,000 to 50,000	1 drop to each 15 population
50,000 to 150,000	1 drop to each 20 population

Where switchboards are of multiple construction the ultimate capacity need not be installed at the beginning.

The comparison between what the Bell has accomplished in 20 years and the Independents in four years is more favorable in the adjoining state of Missouri than in Illinois. The Independents have 154 exchanges, 500 toll stations, 3,600 miles of toll lines and 24,000 telephones; while the Bell people possess 19 exchanges, 170 toll stations and 11,000 telephones. Eight towns have competing exchanges and 71 have competing toll stations. The Independents have 146 exchanges with no competition and the Bell have 11. Various Independent companies are now seeking franchises in these 11 Bell towns.

Kansas has also invested a large amount of her "prosperity" in Independent plants, having at this time 70 Independent exchanges, 8,500 telephones and 21,000 miles of toll lines, with Bell competition of 12 exchanges and 3,000 telephones.

1. Address before the Western Independent Telephone Association of Illinois at Carlinville, November 2, 1899.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The People's Telephone company of St. Charles, Minn., denies that it has passed under the control of the Northwestern Telephone Exchange company. It has made toll connections with the latter company, it admits, but claims to be as independent as ever.

A number of farmers in the western part of Mamre, near Willmar, Minn., have organized a telephone company.

The Mississippi Valley Telephone company set poles in an alley in Northeast Minneapolis in what seemed the center of the alley. The property owners objected, but investigation showed that the company had planted its poles on the edge of the alley and that the property owners had placed their fences and barns 10 feet back from the line. They supposed it was a 20-foot alley, whereas it was but 10.

It is evident the Bell interests are going to cover the field in the Northwest, if it is possible. The Northwestern Telephone Exchange company has received word that the Erie Telephone and Telegraph company will expend through this section $2,000,000 in 1900 and 1901. The Iowa Telephone company proposes to expend $1,000,000 in that state next season.

The telephone girls of Minneapolis proposed a union for the purpose of securing shorter hours, but the Northwestern company has reduced their hours from 9½ and 10 to nine hours. The idea of a union has been dropped.

Advances have been made to consolidate the Northern Minnesota Telephone company of Park Rapids, Minn., and the projected Park Region Telephone company of Wadena, Minn. The fields of the two companies would be practically the same, and it would be cheaper in the end to have but a single company.

The Mississippi Valley Telephone company of Minneapolis now has toll connection with Faribault and Mankato, Minn., over the Greene and Western company's toll lines.

The Northwestern Telephone Exchange company has completed a branch to Clearwater, Minn.

The Sheboygan County Telephone company of Sheboygan, Wis., is pushing work on toll lines to all towns in the vicinity. An exchange will be established in Sheboygan Falls. Toll connection with Milwaukee is promised.

A new telephone exchange is being installed at Hastings, Minn.

The new telephone exchange being established at Waterville, Minn., will require nearly all the connections of the 100-drop switchboard which has been put in.

Telephone connection is being made from Aitkin, Minn., along the wire fence of the Northern Pacific railway, with Rossburg and Kimberly.

The Redwood Falls (Minn.) Telephone Exchange company has its system completed and has 75 connections.

The brickwork has been completed for the new building of the Cedar Valley Telephone company at Waterloo, Ia.

The Oregon Telephone company has completed connection from Portland to Coos Bay.

The Cedar Valley Telephone company will install an exchange at Eldora, Ia.

Contact with an electric-light wire in Seattle, Wash., wrecked 150 telephones. There were 308 wires affected.

The Odebolt (Ia.) Telephone company is an applicant for a franchise at Denison, Ia.

Work has been started for a new building at Butte, Mont., for the Rocky Mountain Bell Telephone company.

The Iowa Telephone company expects to enlarge its switchboard at Dubuque, Ia., soon, owing to the increase in subscribers.

The Oelwein (Ia.) Telephone company is extending toll lines through the county and into adjoining counties.

The telephone system at Sheldon, Ia., is to be rebuilt.

Mr. Kathrens, who proposes a new telephone system at Davenport, Ia., Moline and Rock Island, Ill., announces that he will have the Tri-city Mutual Telephone company incorporated.

The city electrician of Davenport, Ia., will inspect subway systems for telephone wires in other cities.

The Hawkeye Telephone company has installed an exchange with 200 connections in Pella, Ia.

The Seattle (Wash.) Automatic Telephone Exchange company has asked permission to erect poles for its system.

The local telephone service at Courtland, Minn., has been discontinued by the Northwestern Telephone Exchange company, which has put in a booth only.

Grafton, N. D., has increased the number of telephones used from 60 to nearly 100 during the summer.

The Mississippi Valley Telephone company has a force of 300 men and 15 teams at work in Minneapolis.

C. W. Baumbach and others of Wadena, Minn., have formed a telephone company which will probably be called the Park Region Telephone Exchange company. Exchanges will be installed at Staples, Minn., Long Prairie and Perham, and toll

lines constructed to Long Prairie, Bertha, Clarissa and Eagle Bend.

Farmers of Eagle Point, Wis., are forming a company to build a telephone line to Chippewa Falls, Wis., and to establish an exchange in the latter city.

Aaron F. Knebel has been granted a franchise for a telephone exchange at New Paynesville, Minn.

The Northwestern Telephone Exchange company has secured control of the local exchange at St. Charles, Minn. There is talk among the business men of St. Charles of forming a new Independent company.

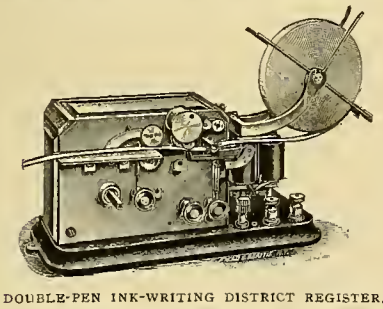
Rochester to Have Vigorous Competition.

Rochester, N. Y., has never taken kindly to the Bell monopoly, as all who are familiar with the famous "telephone strike" of 1886-1888 are aware. There is, therefore, every prospect that the Independent company in that city, just reorganized as the Rochester Telephone company, will be cordially supported. In its new form the company, formerly the Home Telephone company, is known as the Rochester Telephone company, and the capital stock has been increased from $150,000 to $400,000 by new articles of incorporation. The territory in which the company may operate is also enlarged to include not only the city of Rochester, but practically all of Central and Western New York. The directors are Frederick Cook, Thomas W. Finucane, George W. Archer, Albrecht Vogt, H. W. Davis, Gustave Erbe, George R. Fuller, Jacob Gerling, J. Foster Warner, Edward W. Peck, Horace C. Brewster, Eugene H. Satterlee, Willard B. Spader, V. Moreau Smith and Ezra M. Higgins, all prominent business and professional men of Rochester. The company has already secured over 2,000 contracts for telephones, and it promises the best of construction and service. An exchange building, said to be a model of convenience, is now under construction on Stone street. The operating room will be 29 feet wide and 93 feet long, with a skylight over the whole length of the switchboard. The Stromberg-Carlson company of Chicago is building the switchboard, and cables of the Standard Underground Cable company will be used in the outside construction. It is hoped that the exchange may be opened on May 1st next.

Double-pen Ink-writing District Register.

The instrument illustrated in the accompanying picture, which has been known to the trade as the Greeley ink-writing register, on account of its many practical points is believed by its manufacturers, Foote, Pierson & Co., 82-84 Fulton street, New York (successors to E. S. Greeley & Co.), to be without rival on the market, both as to its high grade of workmanship and the reliability and perfection of its operation. The design of the instrument is thoroughly practical and overcomes all weak and troublesome features that are said to exist in other types of registers. All wearing parts are so arranged that they can be easily removed and replaced with new parts without taking the instrument out of the circuit, thus avoiding the expense and trouble of sending the instrument to the makers for repairs.

The operation of the instrument is entirely auto-



DOUBLE-PEN INK-WRITING DISTRICT REGISTER.

matic; it starts itself promptly at the opening of the circuit and stops automatically as soon as the circuit returns to its normal state, preventing waste of paper. It is self-adjusting and does not require any attention and readily adapts itself to any variations of current. If started accidentally by derangement of the circuit it stops automatically, preventing the danger of paper reeling off unnoticed and the record being lost. It is said that the paper cannot, through momentum, run crooked, unreel or entangle. As the record is blocked out upon white tape in solid black color it can be read at a glance, and, being indelible, may be preserved and read years afterward. It does not require inking oftener than once a week, except when new. The registers are built to operate on any number of circuits desired, the number of pens being unlimited. They can be arranged for any special service where ink records on paper are desirable. The ink used in these registers is manufactured by Foote, Pierson & Co., and is especially prepared for use on the instruments.

One of the highest recommendations of the merits of this instrument lies in the fact that its manufacturers can point to its use in station all over the United States.

Mr. Glidden's Directors Vote for a $10,000,000 Increase of Capital Stock.

President C. J. Glidden of the Erie Telegraph and Telephone company, with headquarters at Lowell, Mass., is certainly one of the greatest hustlers in the Bell telephone field. He recently attracted the attention of every telephone man and inventor in the country by an offer of $1,000,000 for a practicable telephone repeater. He has lately returned from a trip to Europe, where he inspected the telephone practice on the other side; and now the directors of his company have recommended that the capital stock of the company be increased from $5,000,000 to $15,000,000. The stockholders will pass on the directors' recommendation at a special meeting to be held in New York on December 15th. In a circular letter to the stockholders Mr. Glidden says:

"The phenomenal growth of the telephone throughout the territory known as the 'Erie system,' namely, a net gain of 35,930 subscribers during the 10 months ending with October 31st, and the large increase of the long-distance service, indicate that the new business during the years 1900 and 1901 will increase the Erie system from 98,673 subscribers (October 31, 1899) to 200,000 subscribers. The large increase of subscribers will be accompanied by a proportionate increase of the long-distance service. To provide funds to pay the cost of the new additions to the plants of the several companies composing the Erie system, the directors have recommended that the capital stock be increased from $5,000,000 to $15,000,000, the new stock to be issued as funds may be required. It is estimated that during the year 1900 at least $5,000,000 can be profitably used, and stock representing this sum will be offered to stockholders at par in installments when funds are needed to pay the cost of new property acquired.

"The following is a statement of the earnings of the sub-companies for the year 1899, as compared with the year 1898 (the three months ending December 31, 1899, having been estimated):

	1899	1898.	Changes.
Gross earnings.....	$3,790,000	$2,818,477	Increase..$971,522
Gross expenses.....	2,400,000	1,997,675	Increase.. 402,325
Net earnings.....	$1,390,000	$820,802	Increase..$569,197

"The return upon the money heretofore invested indicates that the new money can be invested to such advantage that the company can maintain its present rate of dividend and lay aside a satisfactory surplus for contingencies."

It is worthy of note that Mr. Glidden was an interested spectator at the tests of the Pollak-Virág automatic-telegraph system in Chicago. As this system comprehends a telephone receiver in a scheme of rapid telegraphy, Mr. Glidden's interest in it may have possibly more significance than that of the man simply interested in all industrial advancement. But, like the telephone, the Pollak-Virág system does not lend itself to the operation of a repeater.

GENERAL TELEPHONE NEWS.

The Baltimore, Annapolis and Drum Point Telephone company (Independent) is selling its property to the Chesapeake and Potomac Telephone company (Bell) for $11,500, which will repay stockholders about 90 cents on the dollar. Inability to secure sufficient capital to complete the line to Baltimore is given as the reason for selling. The Bell company promises to continue to operate the lines.

A committee of city officials in Montreal has had an application before it for the privilege of erecting poles and wires for a new telephone company. This application was contained in a communication from Benton R. Dodge of Post Mills, in the state of Vermont, who is an inventor of a system which he calls the Dodge system of telephones. The communication asked that permission be granted to a joint stock company to erect poles and wires in the streets of the city, together with such other rights as were requisite to the providing of a telephone service. Considerable opposition, however, was shown by the committee to the erection of more poles in the city streets. It was decided to ask Mr. Dodge to furnish fuller particulars as to his proposition, and to state whether he was willing to put his wires underground, what bonus he proposed offering the city and what his rates for telephones would be.

EXTENSIONS AND IMPROVEMENTS.

The Northwestern Telephone Exchange company is putting in a new toll-line switchboard at New Ulm.

The Southwestern Telegraph and Telephone company (Bell) is building a line from Waco to San Antonio, Tex., by way of Austin.

The material for the exchanges in Sleepy Eye and Springfield has been ordered, and with favorable weather the plants will be in operation early in 1900.

The Southern Minnesota company is stringing wires along the new St. Louis extension through Brown and Blue Earth counties, touching Lake Hanska and Searls, between New Ulm and St. James.

Telephone, Telegraph and Cable Company of America.

In New York there have been rumors to the effect that the new Telephone, Telegraph and Cable Company of America was formed with the purpose of combining the Independent telephone-exchange companies of the United States under one control and then delivering them over to the Bell company. These stories are denied, however, by officers of the new company, who say that contracts for 18,000 miles of wire and 43,000 poles have been awarded. It is stated that the new company has secured control of the New England and Eastern Telephone company, which in 1894 obtained a franchise to operate a telephone service in the city of Brooklyn. The company has been operating a few instruments since in order to retain its charter. The charter gives to it the right to operate in any of the streets of Brooklyn, to use overhead wires, and also grants to the company the right to build subways, making it the only company having that right in Brooklyn.

It is asserted that negotiations between the People's Telephone Corporation of New York and the Telephone, Telegraph and Cable Company of America, having for their object the inclusion of the People's company in the new company, have been reopened. In the meantime the People's corporation announces that it is practically ready to begin the actual work of installing its proposed Independent telephone system in New York, under the permit granted by Commissioner Kearny, allowing it the use of the subways. Engineers have been put at work, it is said; cables have been ordered, and the work of stringing the cables through the subways will be begun in a few days. A committee, consisting of Frank Brainard, Major J. Fred Ackerman and Elias S. A. De Lina, has charge of the preparations.

The Philadelphia Evening Bulletin of November 27th says: "The plan to control all of the Independent telephone companies in the United States and to combine these with the great telegraph companies and the five Atlantic cable companies, for which purpose the Telephone, Telegraph and Cable company of America was incorporated, on November 9th, with a capital of $30,000,000, received a severe blow to-day by the withdrawal from the scheme of William C. Whitney, Thomas F. Ryan, Anthony N. Brady, William L. Elkins, P. A. B. Widener and Thomas Dolan, the men whose support made the success of the enterprise possible and whose opposition or indifference may be fatal to its existence." It may be remarked that Mr. Whitney had previously announced that he was not connected with the company.

BOOK TABLE.

TELEPHONES: THEIR CONSTRUCTION AND FITTING. By F. C. Allsop. New York: Spon & Chamberlain. 1899. Fifth Edition. Price, $1.25.

This new edition of Mr. Allsop's book is of value to the practical telephone man, for in it the fitting and maintenance of telephones and auxiliary apparatus are thoroughly and practically treated. In preparing the edition it was found necessary to rewrite a considerable part of the volume in order to bring it completely up to date. Considerable space is given to the description of many different forms of receivers, transmitters, switch bells and complete instruments. Switches, switchboards, extension bells and batteries are also well treated. Practical instruction on the working and fitting up of telephones is given and the book will be found helpful by those who are not thoroughly skilled in telephone construction and fitting. Of practical value, also, is a very complete series of diagrams, dealing with almost every combination and variety of insulations. Chapters on the intercommunication system, testing for and removing faults, and the working of a public exchange will be found instructive by all interested in telephony.

NEW COMPANIES.

The Flemingsburg (Ky.) Telephone company has been incorporated by J. H. Powell, J. M. Baldwin and others; capital stock, $2,500.

The Nevasota (Tex.) Telephone and Construction company has been incorporated, with a capital stock of $10,000, by T. C. Foster, Ward Templeman and A. H. Ketchum.

The Federal Telephone company has filed a certificate with the secretary of state of New Jersey that its entire $10,000,000 of authorized capital stock has been issued, $2,000 in cash and the balance in the purchase of property.

J. Arthur MacMurty, general manager of the Patent Exchange and Investment company, Toronto, writes to the Ottawa (Ont.) City Council: "We are directed by our client, Benton R. Dodge of Post Mills, Vt., inventor of the Dodge system of telephone, to ask your council to consider the granting to a joint stock company, organized to take over the system of telephone, the right to erect telephone poles on the streets of your city, and any other privileges that such a company may require in establishing and erecting telephone lines in your city of Ottawa."

New Type Sunbeam Lamps.

For the last year the Sunbeam Lamp company has been making extensive changes and improvements in its factory equipment and appliances, and has introduced the latest and most improved processes in the manufacture of the new-type Sunbeam lamp. The maintenance of candle power and efficiency of the incandescent lamp are due in a great measure to a perfect vacuum. Every lamp of the new type Sunbeam is individually exhausted, both mechanically and chemically, and the vacuum thus obtained is said to be as nearly perfect as known methods can produce. Careful attention is given to the mechanical construction of the lamp.

The illustration, which is a full-size picture of the new type, 16 candle power, 110-volt lamp, shows the general style and appearance of the Sunbeam lamps. In addition to the regular standard lamps for 52 and 110 volts, the Sunbeam Lamp company has made a specialty of lamps for street-railway and 220-volt circuits. The railway lamp is constructed particularly to withstand the vibration and

NEW TYPE SUNBEAM LAMP.

variation in voltage usually existing in railway service. The Sunbeam company is said to be a pioneer in introducing low-candle-power lamps for sign and decorative use. It manufactures lamps from two up to 100 candle power.

The 20-page Sunbeam catalogue recently issued is believed to be one of the most artistic catalogues issued on lamps. It contains complete descriptions and illustrations of the new lamps. The frontispiece gives a handsome illustration of the factory, and on the introductory pages are shown interior views of the factory. The Western Electric company of New York and Chicago is the exclusive agent for the new-type Sunbeam lamp.

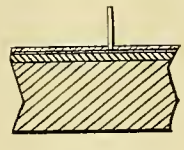
Eddy Kite Experiments.

Several experiments have been made recently at Bayonne, N. J., by William A. Eddy, the kite expert, in his endeavor to determine the location of distant storms. Mr. Eddy's initial effort to discover the proportion between the distance of a storm's center from the point of observation and the quantity of atmospheric electricity manifested was made November 18th. Two tailless kites of the Eddy type, measuring 49 square feet each, were attached to 23-gauge Bessemer steel wires and raised to different heights. Sparks drawn from the kite wire were found to vary in direct proportion to the heights, so an elevation of 1,000 feet was taken as a standard. At this height the spark of atmospheric electricity discharged from the kite wire to the ground rod was one-eighth of an inch long, recurring every eight seconds. The barometer measured 30.3. As it was known from the Weather Bureau that there was a storm center above Lake Superior with a barometric pressure of 29.9, this distance of 1,000 miles was taken as a basis for future experiments. Ordinarily longer sparks are obtained from the apparatus, so the short ones that were given in this experiment were taken by Mr. Eddy to indicate the presence of a storm. Later in the day shorter and more frequent sparks were obtained, showing, according to the experimenter, that the storm center was moving north into Canada.

Wrinkles in Rheostat Manufacture.

It is safe to say that many, even among the electrically educated, might be led to imagine from the general simplicity in construction of the ordinary electrical rheostat that the manufacture of such a device presents no problems or features of especial interest. However, a visit to the factory of the Ward Leonard Electric company at Bronxville, N. Y., and an inspection of the details and technicalities of rheostat manufacture reveal the fact that rheostat manufacturers are confronted with problems the solution of which have necessitated years of thought. And further, it is seen that this supposedly simple device has only become successful through a simplicity attained after much thought and many trying experiments. In fact, the successful rheostat, in spite of its extreme simplicity, contains many "fine points" which are worthy of remark as showing progress in the electrical art.

For instance, the early manufacturer in attempting to produce an enamel rheostat used the potter's ordinary enamel and a wire of round cross-section. But nowadays there are few in the electrical industry who are not aware of what is liable to happen where an inexperienced operator experiments with such a combination. Early in its career the Ward Leonard Electric company became impressed with the great advantage in employing a ribbon-like conductor instead of a round conductor, as many had used theretofore. This advantage may be shown by comparing a round conductor having a diameter of 0.05 of an inch with a ribbon-like conductor having the same cross-sectional area and a thickness of but 0.002 of an inch. H. Ward Leonard, the patentee of this "ribbon type of rheostat," found this thickness to be entirely commercial by experiment. The cross-section of the round conductor assumed is about 0.002 of a square inch. The width of a ribbon-like conductor of 0.002 of an inch in thickness and having the same cross-sectional area as the round conductor will be one inch. In the case of the round conductor the available surface for emitting the heat energy per inch of length will be 0.157 of a square inch. In the case of the ribbon conductor the available surface for emitting the energy is two square inches for the same length of conductor. Hence the relative surface



WRINKLE IN RHEOSTAT MANUFACTURE.

for dissipating heat in the case of the round conductor and the ribbon conductor will be as 0.157 is to 2, or as 1 is to 12.7.

The manner in which such a ribbon could best be supported for its various surfaces was another problem that resulted in Mr. Leonard's securing a patent that greatly simplified and perfected the manufacture of such rheostats. Where what might be called ordinary enamel was used and the ribbon embedded edge up, as is roughly indicated in the cut, practice and service demonstrated that even the slight expansion and contraction of a thickness of even so fine a ribbon produced the cracking of the enamel, and after repeated experiments this led to Mr. Leonard's patenting a process through which this cracking and rupturing of the enamel was prevented.

Experiments with enamel and ribbon proved that the best results are obtained when the support is given two insulating coatings of quite different materials. The lower or ground coat should be pottery-like in nature; that is, it should become a hard and coherent mass when subjected to the heat of a muffle-furnace, and it should not become soft or viscous even at the highest commercial heat of a muffle-furnace. It should be somewhat porous, that is, somewhat "brick-like," so that it will have to the greatest degree the qualities of toughness in resisting strains, and so that it will have the least tendency to crack. The material for this ground coat should contain a very high percentage of silica or other equivalent infusible material. The ground coat preferably should be a mixture of material which at the heat of a muffle-furnace is practically inert and infusible, such as clay, and a material which will fuse at the heat of the muffle-furnace, such as a low-fusing glass. This mixture of inert material and low-fusing glass, before being supplied to the suport, is finely ground and intimately mixed. When this fine mixture is heated, the glass becomes fused and acts as a binder for the inert material, producing a coherent mass, and also adhesively attaches the coating to the support. The mixture for the ground coat is applied either as a dry powder or as a wet powder, in which case the mixture will be in the form of a paste. In either case the layer is caused by heat to become a solid layer adherent to the support.

By "powder" is meant material in a finely divided state, whether it be dry, or mixed with a fluid so as to be paste-like or cement-like, or whether it be suspended in a liquid so as to be paint-like.

One may apply the ground-coat powder in the form of a paste. That is, "flow" the ground coat over the surface of the support in the form of a liquid mass having about the consistency of thick cream. This forms a thin layer of the powder, and when it is dried a thin coat of the powder remains on the support. If, now, the object having this coat be heated in a muffle-furnace, the minute particles become bound together by the softening of the glass particles and form a layer of solid material, and the glass particles also cause the layer to adhere to the surface of the support. That is, there is in the material fusible matter enough to cause the particles to become bound or welded together at the heat of the muffle, although not enough to cause the mass as a whole to become soft or viscous, as ordinary glass or enamel would become. This ground coat when removed from the furnace at a bright-red heat is preferably so hard that a hard implement pressed lightly against the surface makes no impression therein. For the purpose of description this material is called "infusible."

In the manufacture of electrical apparatus, such as rheostats, a cast-iron plate for the support is generally used. It becomes important to have the insulation of the conductor from the iron plate as high as possible. This means not only material of high specific insulation for the ground coat, but as great a thickness as possible consistent with good results.

Now, if a thick layer of the ground-coat paste is applied at one operation it is found that many difficulties develop, especially the development of cracks in the ground coat either before, during or after the firing. Hence, in cases where it is desired to obtain extremely high insulation, especially when high electromotive-force static discharges are met with or when one pole of the electric circuit is grounded, as in electric-railway rheostats, successive layers of the ground-coat powder are applied and fired independently. It is important that the ingredients of the ground coat be almost inert chemically, so as not to combine except slightly with the metal in contact therewith when the whole is subjected to the heat of the muffle in subsequent steps of manufacture. Any tendency on the part of the ground coat to form a slag with the metal would injuriously affect the insulation between the conductor and the support.

It was found that cast-iron is especially troublesome to make use of, because its surface oxidizes so readily, and because of the chemical nature of the so-called "skin" of cast-iron, and because of its coefficient of expansion. Hence, with cast-iron it becomes of especial importance to use a material for the first coat which is chemically almost inert. If the material used for the ground coat on cast-iron is one which at the heat of the muffle-furnace becomes molten, the result is a strong chemical action between the cast-iron and the molten vitreous material, resulting in bubbles, blisters, etc., and also resulting in poor insulation. For this reason Mr. Ward Leonard's invention is of especial importance for cast-iron. In the case of copper, silver, gold, wrought-iron, low-grade steel, etc., such as are ordinarily covered with vitreous coatings in the arts, this difficulty is not met with to a troublesome degree.

The small figure indicates the simplicity of the three-layer method of attaching the ribbon to its support, whether it be cast-iron or other material

Federal Salt for Batteries.

Federal salt, a new battery compound which is being put on the market, is said to be superior in many respects to salammoniac as a battery electrolyte. It is asserted that Federal salt gives higher electromotive force and lasts longer than salammoniac, and that this is due principally to a lower internal resistance and the formation of no crystals whatever on the carbon and zinc. In addition to this, the electrolyte itself contains its own depolarizer, which, in conjunction with the other salts present, has more heat units than salammoniac, and consequently higher electromotive force. As there is no insoluble matter produced, the internal resistance is lessened as the zinc salt is formed, the electrolyte thus becoming a better conductor. This is said to be conclusively proved by the increase of amperes as the cell is used. In a salammoniac solution the internal resistance increases as the oxychloride of zinc crystals are formed and reduce the surface of the carbon and zinc. These crystals, which clog the pores of the carbon, prevent a rapid recuperation and lessen the efficiency of the cell.

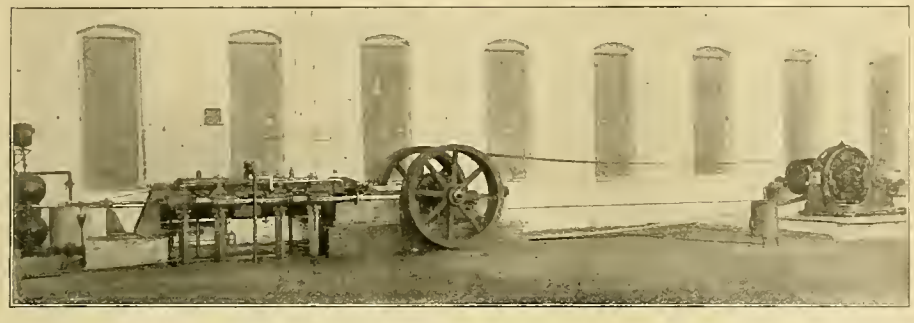
A characteristic of a Federal salt solution which does not appear in a salammoniac solution is the white milky appearance the electrolyte shows when the cell is nearly exhausted. This gives a timely warning. Another feature of Federal salt is its entire freedom from creeping salts. When salammoniac is dissolved in water it produces intense cold. The glass jar at once begins to condense moisture on the outside of the jar, which continues more or less during the life of the cell as the ammonium is liberated. The salts have thus a medium through which to diffuse and creep over the jar

and carbon. It is asserted that Federal salt has no chemical action of this description, and is consequently free from creeping salts. Federalite, a similar product, has the same advantages as Federal salt, but contains slightly less depolarizer and is sold in bulk cheaper than salammoniac.

The Federal Battery company of New York is the manufacturer of Federal salt and Federalite. The company reports that it has received numerous reports from telephone, railroad companies, etc., which give very satisfactory evidence of the merits of its products.

Gas Engine of 200 Horse Power Driving Railway Generator.

In the illustration is shown a tandem gas engine belted to a 150-kilowatt Westinghouse generator of the Oil City (Pa.) Street Railway company. The gas engine was built by the Standard Automatic Gas Engine company of Oil City. It has two 18 by 18-inch double-acting cylinders tandem on one piston rod, with outside cross-head of standard steam-engine construction. The two double-acting cylinders give two forward impulses a revolution, simultaneous with the compression strokes in the other end of the cylinders. The heavy compression both ways gives smooth running, even with considerable slack in the cross-head and crank-pin boxes. The piston rod of this engine is made of nickel-steel, drawn with the hole for cooling water in it. The water is introduced through the cross-head and discharged through a tail rod. The pistons are cored out and the water passing through the rod is compelled to circulate also inside the pistons, thus cooling them. One horizontal shaft runs along beside the cylinders and turns the four valves of this engine (one for each end of each cylinder), through two pairs of cut gears. The governor actuates one butterfly valve, which throttles the mixture to all four cylinder ends. The course of the mixture to any one, two or three of the four cylinder ends may be cut off to increase the compression and economy at low loads. Indeed, it is said that any valve chest may be opened and the igniter taken out while the engine is running. The engine is started either by a charge of air under pressure or by turning it over to the proper point and igniting electrically a charge of very slow-burning powder in an enclosure connected with one cylinder head.



GAS ENGINE OF 200 HORSE POWER DRIVING RAILWAY GENERATOR.

A duplicate engine is under way for the railway company and two of 500 horse power each are under order. No storage batteries will be used.

The engines are rated on the basis of mean effective pressure, the one shown in the illustration being conservatively rated at 200 horse power, on the basis of a mean effective of 32 pounds to the square inch, although much higher mean effectives may be obtained. Indeed, the engine is guaranteed to develop 300 brake horse power, with a consumption of not more than 3,000 cubic feet of natural gas per hour, this gas showing about 990 British thermal units per cubic foot.

An interesting equipment of engines for which the Standard company has closed a contract will consist of four like that shown in the illustration, which are ordered for use in Germany. These will be made into two engines by coupling two of them together with cranks at quarters, each complete engine thus consisting of two pairs of tandem, double-acting cylinders, giving four impulses per revolution. Each such engine will be direct-coupled to a three-phase, 60-cycle alternator, mounted between the cranks and these alternators will be run in parallel and with rotary converters. Another order is for two engines of 350 horse power each, to carry a street-railway load in western Pennsylvania. These engines will get their gas from by-product coke ovens, a gas which is at present thrown away, and will require no elaborate preparation, such as washing or scrubbing, to adapt it for use in the engines. All it needs is to be passed through holders in which it can deposit its tar.

Mr. J. W. Raymond, for several years with the J. I. Case Threshing Machine company, is president of the Standard Automatic Gas Engine company and its engine designer. The engine operates upon the familiar Beau de Rochas or four-stroke cycle, commonly known as the Otto, giving for a single cylinder one impulse during two revolutions. The special feature is the valve and valve gear. There is only one valve for both admission and exhaust, and this valve is a hollow cylinder of cast-iron. This valve turns in the valve chest, an opening in the valve alternately connecting the cylinder port with an admission and an exhaust port. The valve simply rolls continuously around in one direction, being turned by a horizontal shaft driven by miter gears from the main shaft and turning the valve stem by spur gears. The ignition is electrical in character, accomplished by a wiping spark between wide tool-steel electrodes. The moving contact is driven by the valve and the stationary contact is held by springs outside the valve chest and adjustable while the engine is in operation. The governing of this engine is not accomplished by missing impulses, but by varying the quantity of the charge by throttling. The mixture is throttled by one plain balanced butterfly valve. The proportions of the mixture are determined by entirely independent valves in the incoming air and gas pipes, the constituents being pulled through these and the mixture being pulled through the governing valve by the suction of the filling stroke. The engine is horizontal and in small sizes, 15 horse power and upward, is of the ordinary single-acting form, with a trunk piston acting as a cross-head.

New York's Large Power Stations.

Dwelling on the large size of the three great power houses building or planned for the surface and elevated-railway systems of New York city, the Scientific American says that when completed they will each exceed any other aggregation of motive power in the world so greatly as to be by comparison positively mammoth in their proportions. The first of these to be completed will be the central station of the Metropolitan Street Railway company, with a total capacity of 70,000 horse power, and following this will be an 80,000 horse power station for the electrical operation of the system of the Manhattan Railway company, and an even larger station, with a reported maximum capacity of 100,000 horse power, for operating the electric roads of the Third Avenue Railroad company.

Until within a very recent period the largest aggregation of horse power was to be found in the engine rooms of the big Atlantic liners. The twin engines of the Cunard liner Campania, for instance, indicated 33,000 horse power on her trial trip, each engine developing about 16,500 horse power. This has probably been surpassed by this time in the power house of the Niagara Falls Power company, where the erection of the last of the 10 5,000 horse power turbines must be nearing completion. Apart from the hydraulic installations at Niagara and elsewhere, there is to-day no single power station in the world where the collective horse power of the steam engines equals or even approaches that to be found in the Campania, Lucania, Kaiser Wilhelm, or St. Paul.

The Metropolitan Street Railway company's station, however, will exceed the maximum output of the Lucania's engine room by over 100 per cent. When completed it will include 11 cross-compound engines of 6,600 maximum horse power, and the whole series could be completed and in operation early in the coming year should the demands of the system call for such an output by that time. The preliminary design for the power house of the Manhattan company provides for eight huge four-cylinder, compound engines, each capable of developing 10,000 indicated horse power. Two of the cylinders will be carried vertically above the crank-shaft, on the usual A-frames, and the other two will be placed horizontally, all four cylinders working upon a common shaft. The size of these engines may be judged from the fact that each one will be capable of developing more power than the total output of any but a few of the largest steam-driven central stations in the country.

Large Patent Office Gazette.

Last week's issue of the Patent Office Gazette is the largest ever sent out by the government. It contains 322 pages, with 535 patents recorded, 59 of which were of one classification and issued to one assignee. These latter patents relate to printing-presses and multi-color printing, and all but four of them were granted to one applicant. Over 40 patents are recorded which are of an electrical nature.

Transfer of Chicago Edison Company Abandoned.

By an official statement given to the public last week it is made clear that the plan of transferring the stock of the Chicago Edison company to the "Whitney-Widener-Elkins syndicate" and reorganizing the company has failed of consummation. The language of the circular is as follows: "The undertaking of a party of eastern capitalists and others to acquire control of the Chicago Edison company and recapitalize it in a new corporation has been abandoned. This action has been taken after due consideration, in view of the fact that considerable opposition to this movement had developed in the local field and there was a probability of litigation which would unfavorably affect the securities of the Chicago Edison company. It is not taken in view of a possible failure of the undertaking through inability to obtain a majority of the stock. Already 23,000 shares out of a necessary 24,880 had been secured, and the task of securing the remainder would have been very easy. The Illinois Trust and Savings Bank was instructed yesterday morning not to receive any further stock for deposit." It is asserted that the plan has been definitely abandoned, rather than temporarily postponed, and the news gave great satisfaction to employes of the company and others in Chicago.

Apropos of the failure of the plan, the Chicago Inter Ocean gossips as follows: "The real reason appears to have grown out of the fact that a large capitalist declared he would not turn in his stock unless he were paid $200 per share in cash. Accompanying this demand was a threat to bring about litigation if the demand were not complied with. When this became known to another large stockholder of the company, a bank president, he declared that before the particular capitalist in question should receive better terms than other shareholders he himself would go into court and prevent such cash payment being made. The Edison company has now, in the Chicago Union Traction company, a powerful potential competitor in the field. The crowd which controls the traction company also controls the Illinois Electric Vehicle Transportation company, which will in time be a large consumer of electric current. At present it is presumed the Traction-Vehicle people will prefer the friendship of the Chicagoans in the Edison company. But in time, with a changed situation, business will dominate sentiment, and either competition or the absorption of the Edison company will follow. The Edison company will now issue the $1,000,000 of stock voted a short time ago. Either $500,000 or the entire $1,000,000 will be put out early in the coming year."

American Electrical Machinery in England.

Mr. C. H. Wordingham of Manchester has written an interesting letter to the London Electrician, giving some reasons, deduced from practical experience, why American electrical plants have been ordered to such a large extent of late for use in Great Britain. Mr. Wordingham says:

"As the responsible adviser to a corporation which has recently given a large order to an American—though let us not say foreign—firm, I may perhaps be allowed to state the case of the municipality. Some three years ago it was determined to put down a slow-speed, continuous-current generator of 1,500 kilowatts, and so far as I am aware no such machine of even one-fourth of this capacity had been built in England at the time, though they were common in America. Did we go abroad? No. We did not even ask any but English firms to tender, and we awarded the contract to an English company, who guaranteed delivery by a certain date. The first run took place 14 months late. In consequence of this breach of contract we had to stop connecting new consumers and to work our existing plant nearly 25 per cent. above its rated capacity, with great loss of economy, to say nothing of the risk of breakdown. Notwithstanding this severe blow to the undertaking, we ordered our next generator of the same size from another English firm, who, like their predecessors, guaranteed delivery by a certain date. That date has passed by 13 months, and the machine is not yet running.

"We have to provide plant for further extensions and for running the trams in about 18 months' time. Any failure to do so would be fraught with most disastrous results, not only to the electricity department, but to the corporation as a whole. In awarding the contract we accepted the tender of an American firm for the dynamos; but we retained the English maker for the engines, as he had already served us well with the two preceding generators, and his share in the responsibility for delay was a small one and beyond his control. The American firm's work is above suspicion and their price was substantially lower than that of English firms, while the delivery of the plant is practically certain. I ask, could any responsible adviser do otherwise than recommend the acceptance of the American plant, when the undertaking had already been nearly wrecked twice by an honest endeavor to support English manufacturers? Patriotism is a virtue that none appreciate or admire more than I, but to let it run away entirely with common sense would, in my opinion, be culpable folly."

CORRESPONDENCE.

New York Notes.

New York, November 25.—After a long delay, attributed to many causes, the Third avenue electric-railway line is completed. The first car of the new system rounded the loop at the postoffice early Friday morning.

Increasing competition of electric and other motor vehicles, it was reported in Wall street recently, has induced the powerful cab and hack companies of the city to take into consideration a plan of consolidation to reduce expenses and improve the carriage service of the city.

Several applications for plans for the underground rapid-transit road have been made to William B. Parsons, chief engineer of the commission. So far, however, only two of the applicants have definitely announced that they will bid—the Third Avenue Railroad company and the United Engineering and Contracting company, of which David L. Hough is president.

Two exciting runaway accidents in Prospect Park, Brooklyn, on Tuesday afternoon, in which two women narrowly escaped being killed, have caused Park Commissioner George V. Brower to announce promiscuous use of the roads in the park on the part of owners of automobiles at an end. Only such owners of automobiles as will be willing to subscribe to a set of rules now being formulated by Mr. Brower will be allowed use of the park, and then only a restricted portion of it.

Although no positive confirmation can be found in official quarters, it is intimated among interests identified with the American Steel and Wire company that control of Witherbee, Sherman & Co.'s mining properties at Port Henry, N. Y., has been obtained. It was stated some months ago that John W. Gates and other financiers connected with the Steel and Wire trust had taken an option on the Port Henry mines, and also upon the plants of the Troy Steel and Iron company at Troy, N. Y., but since then nothing has been heard of the matter. It is now said, however, that the mining property will be taken over by the Steel and Wire company at an early date, and that at about the same time the Troy plants will pass into the company's control, and will be put in operation again after having been idle for two years.

It is announced that negotiations have been entered into between the representatives of the French government and the company controlling the Holland submarine torpedo boat for the construction of several vessels of the same type, and also for the exclusive use of the patents for the submarine boat by the French government.

As a result of several meetings of the electric-fan manufacturers of the country during the week in this city it has been decided to establish a permanent organization under the name of the American Association of Electrical Fan Manufacturers. With a view to carrying into effect the decisions of the meetings a provisional committee has been appointed, with H. Burd Cassel of Marietta, Pa., as chairman. The objects of the association are to secure better, more stable and, so far as is practicable, uniform prices. The electric-fan industry of the country is in the hands of about 14 firms, and the capital employed in the business is several million dollars. It is said that the Western Electric company will not enter the association.

Another serious explosion of gas occurred this week, and as a result Charles O'Neil, an employe of the Metropolitan Street Railway company, lost his life and six others were injured. The accident occurred Thursday in a trench at Broadway and Canal street that was being dug by the railway company. It is reported that the foreman of the gang of workmen ordered the men to cut through a gas main which he said was not used. As the men were working with lights, the gas which escaped from the pipe exploded. The foreman was arrested on a charge of homicide.

Canadian Intelligence.

Ottawa, Ont., November 25.—The town of Weston, Ont., intends to purchase the water power on the river Humber and run its proposed electric-light plant.

The town of Liverpool, Nova Scotia, has taken up municipal electric lighting and has placed an order with the Royal Electric company of Montreal for a 75-kilowatt, two-phase S. K. C. generator, as well as the full complement of transformers and other apparatus. The plant will be in operation next month.

The Royal Electric company of Montreal was awarded the contract for installing the new electric-light plant to be added to the plant of the corporation of Picton, Ont. The new plant is to consist of one 125-kilowatt S. K. C. two-phase generator, with the full complement of transformers, lamps, etc.

The city of Quebec is likely to have very soon a war of rates between its two electric-light and power companies. The Jacques Cartier company has commenced to string its wires in the city and has purchased a site for its new office. It expects to begin supplying light on December 15th.

P. Lyall & Sons of Montreal have installed a large diamond saw, electrically driven, in their stone-cutting yard. This saw is a part of the $20,000 electric plant recently purchased by the firm, and includes a traveling derrick and two planers.

The Iron Mask Gold Mining company, Rossland, B. C., is enlarging its electric hoist and air compressor, and has placed an order with the Royal Electric company for a 120-kilowatt S. K. C. synchronous motor.

Mr. J. J. Durage of Duluth, Minn., has surveyed the water power of the Seine River, Ont., from Sturgeon Falls to McMannus Falls, a distance of about eight miles. There is a total fall of nearly 100 feet, of which 75 feet is in eight falls. It is feasible to construct power plants for the generation of nearly 3,000 horse power.

The Demarara Electric company has been organized in Montreal for the purpose of doing business in Demarara, West Indies. The franchises of the British Guiana Light and Power company and the Georgetown Tramway company have been secured and it is proposed to convert the system of the latter into an electric road. Engineers have completed the surveys. William B. Chapman, James Hutchison and B. V. Pearson are the provisional directors of the company.

Mr. Edward Slade, the local electrical engineer and contractor of Quebec, has been named to the important position of general manager of the new Jacques Cartier Electric Light and Power company. Mr. Emerson McMillan, banker of Wall street, New York, is the president of the new company.

W.

New England News.

Boston, November 25.—The Brooklyn and Plymouth Street Railroad company has been chartered in Massachusetts with an authorized capital of $150,000, the incorporators being J. P. Morse, H. B. Rogers, E. J. B. Huntoon, H. F. Copeland, O. L. Gurney, Frank Bourne, M. P. Clough, H. L. Higginson, C. E. Cotting and Harry Dutton.

The Boston and Worcester Street Railway company, recently organized with an authorized capital of $750,000, will commence construction of a double track from Brookline, Mass., to South Framingham, Mass., a distance of 35 miles, as soon as franchises and other important details are arranged. At Brookline connection will be made with the Boston elevated railway and at Framingham a single track to Worcester will be utilized. It is proposed to use big cars, 40 feet long, with seats for 50 people, arranged as in steam cars. The directors are James F. Shaw, William M. Butler, Charles C. Pierce, Charles W. Shippee, Samuel Farquhar, Albion R. Clapp and James R. Entwistle, the president being James F. Shaw, who is prominent in various street-railway enterprises in this state.

The Edison Electric Illuminating company of Boston has elected officers as follows: President, Jacob C. Rogers; vice-president, C. L. Edgar; clerk, J. Otis Wardwell; treasurer (succeeding Edward F. Whitney), Raymond F. Apollonio. C. L. Edgar is general manager. The company has declared its forty-second quarterly dividend of $2 a share, payable November 1st.

The Norfolk Electric Light and Power company of Medway, Mass., has been chartered with a capital of $50,000.

There is a proposition before the Gas and Electric Light commissioners to sanction an increase of $500,000 in the capital stock of the Boston Electric Light company, bringing it up to $3,000,000.

A report from the street-railway combine recently formed under the name of the Massachusetts Electric Companies has just been made public for the year ended September 30th. It is the first report of the kind since consolidation took place, and shows an increase in gross earnings of $294,211 for the companies in the combination that were operated both in 1898 and 1899. Five of the companies now operated were not running in 1898, and with the gross earnings including these additional five roads, the amount is swelled to $367,990. Accounts are not completed to show net earnings exactly, but the figures for 11 months indicate that the year will show a good net gain.

B.

PERSONAL.

Mr. E. H. Mullin of the General Electric company recently returned from a short trip to Bermuda.

Mr. E. M. Jones, for six years connected with the Electric Appliance company of Chicago, has recently taken entire charge of the electrical department of the Julius Andrae Sons company of Milwaukee.

Mrs. Julia Marsh Jewell, wife of Edward W. Jewell, president of the McIntosh Battery and Optical company of Chicago, died early on the morning of November 21st, at the early age of 30 years, leaving a husband and a son of 3½ years. Mrs. Jewell, who was a native of Ithaca, N. Y., was a woman of fine character and abounding spirits and of apparently perfect physical health until within a very short time before her death. Her untimely taking off was a great shock to her husband, who has the sincere sympathy of many friends in his bereavement.

ELECTRIC RAILWAYS.

The Lynn and Boston line has been double-tracked through to Lynn. This is one of the first improvements resulting from the absorption of this street-railway property by the Massachusetts Electric Street Railway Companies.

It is believed that the Sprague multiple-unit system of electric-motor equipment and control will be used on the new Boston elevated railway. The cars will be 46 feet long and will seat 46 passengers, with broad aisle spaces. There will be doors at the sides as well as at the ends of the cars.

The opening of a new Detroit suburban electric-railway route—Detroit to Romeo—gives regular service between Royal Oak, Rochester and Romeo. The construction of this line, although started late in the summer, has been rapidly pushed to a successful completion. The route traversed is one of notable beauty and interest.

Consolidation of the West Roxbury and Roslindale, the Norfolk Suburban, the Norfolk Central and the Needham and Boston street railways has been approved by the state railroad commissioners. This is one of the steps in consummation of the deal for absorption of a number of railroads by the Massachusetts Electric Street Railway Companies.

The Massachusetts railroad commissioners gave a hearing on November 22d on petition of the Boston Elevated Railway company for approval of additions to the original plans for the Atlantic avenue elevated structure. A three-track structure is projected for a part of the avenue, near the harbor-excursion steamship and railroad companies' terminals.

The company which is to build an electric railway from Detroit to Toledo has elected the following-named officers: President, Clarence A. Black; vice-president, E. M. Fowler; secretary, A. E. F. White; treasurer and general manager, John M. Mulkey. The board of directors consists of the gentlemen named and Major C. W. Harrah. The company now owns a spur line from Monroe to Monroe Beach. The entire road is to be built on a private right-of-way.

Up to November 21st annual reports, as required by law, were filed by 101 street-railway companies of the state of Massachusetts with the railroad commissioners. Sixteen roads, among which is the Boston Elevated, had not complied with the regulations of the board, and an extension of time was granted in the case of the Boston Elevated, owing to the fact that the annual meeting of that corporation had not been held. Since last year's report 14 new companies have been incorporated, many of which are not yet in operation.

SPACE TELEGRAPHY.

Marconi's system of space telegraphy has been introduced into the British navy as a branch study. The old hulk Hector, lying at Portsmouth, has been fitted out as a school of instruction, and signal men from her will be attached to the battleship Canopus, which goes to the Mediterranean in December, taking Marconi instruments as part of her regular equipment.

A successful public test of space telegraphy under the Johnson-Fortier system is reported to have been given in Milwaukee November 21st. Messages were sent 150 feet and through half a dozen partitions in a leading hotel. The apparatus used in the sending and receiving of messages consists of the ordinary key and sounder in connection with an induction or spark coil. The system is said to be altogether different from Marconi's invention. Pending the issuance of patents the details of the invention are withheld.

The wireless-telegraph company to which allusion was made in the Western Electrician last week has filed articles of incorporation at Trenton, N. J. It is to be known as the Marconi Wireless Telegraph company of America, and has an authorized capital of $10,000,000. Arrangements have already been made for the purchase of the Marconi patents and the acquiring of rights to operate in all the American possessions and in Cuba. The company is empowered to operate over land and sea. The incorporators are Guglielmo Marconi, London; Isaac L. Rice, August Belmont and Clement A. Griscom, New York, and Robert Goodbody, Paterson, N. J. Mr. Rice is to be the president of the new company, Mr. Belmont the treasurer and Mr. Goodbody the secretary.

AUTOMOBILES.

It is asserted that the Sultan of Morocco has ordered a French automobile for his private use.

The first autotruck of the New York Autotruck company has appeared upon the streets of New York city. The wagon is 16 feet long and is run by compressed air, the motor being, it is said, 100 horse power.

The final draft of the rules for the contest for the international challenge cup offered under the auspices of the Automobile Club of France was sent out last week, according to a Paris dispatch, and the Belgian Automobile Club has already given notice

of its intention to compete for the cup next year. Only recognized clubs may race. Up to the present these are the automobile clubs of Great Britain, the United States, Germany, Belgium, Austria, Switzerland and Turin, besides the French societies. The contest is to be held between May 15th and August 15th, over a course by road not less than 340 and not more than 400 miles long. The race will take place next year in France, but in the future it will be at the option of the defending club, either in the country to which the latter belongs or in France. Each of the qualified clubs may enter three motor cars. The vehicles must weigh, when unoccupied, containing neither fuel, water, petroleum, electric accumulators nor luggage of any kind, more than 880 pounds.

PUBLICATIONS.

The Electric Storage Battery company has issued in circular form Mr. Herbert Lloyd's recent article in Cassier's Magazine on "Storage Batteries and Electric Railways."

"Direct-current Laboratory Work in an Electrical Engineering Course" is the subject of a paper by Frank W. Springer, instructor in electrical engineering at the University of Minnesota. This interesting paper was first printed in the proceedings of the Society for the Promotion of Engineering Education, and has now been issued in separate pamphlet form.

The works of the Hazard Manufacturing company, Wilkesbarre, Pa., manufacturer of steel, iron and galvanized iron rope, have recently been extended to include the manufacture of insulated electric conductors. A price-list of bare and insulated copper wires and cables issued by the company covers the products of this new department. Tables of carrying capacities, comparative sizes and weights, resistances, etc., are included in the pamphlet.

To serve as a medium of communication from the main office to the large number of its solicitors and employes throughout the country, the International Correspondence Schools of Scranton, Pa., have issued an organ called the "Official Messenger." The initial number is devoted to a detailed account of the evolution of the International system, a description of the buildings, method of instruction and the business relations of the home office with the man in the field. A number of illustrations of the officials of the Schools and views of the different departments form interesting features of the publication.

With commendable promptness Secretary T. C. Penington has issued the proceedings of the eighteenth annual meeting of the American Street Railway association within a month, practically, of the closing day of the recent Chicago convention. The report makes a volume of 219 pages and is embellished with a fine steel-engraved portrait of ex-President Sergeant. In addition to the minutes of the meeting the volume contains a roster of present and former officers, a very full list of gentlemen and ladies in attendance at the convention, memorials of deceased members and the constitution and by-laws of the association. Altogether, it is a valuable and attractive record of the association's work.

TRADE NEWS.

The Electric Appliance company, Chicago, has issued a Thanksgiving proclamation to electricians to be thankful for Eaco tape.

The Standard Automatic Gas Engine company of Oil City, Pa., is capitalized at $36,000, but is expecting to increase its capitalization to $100,000 to accommodate increasing trade. It has recently erected new shops on the bank of the Allegheny River, about two miles below Oil City. The building contains also the new street-railway, gas-engine power house, and is about 180 feet long by 67 wide. The contracts will soon be let to lengthen it 150 feet.

The possibilities in the way of reduction of fuel cost in modern boiler practice are well exemplified by a series of tests made at the works of the United States Cotton company, Central Falls, R. I. The burning of a low-grade mixture of coal, costing only $2.29 a ton, was rendered possible by the introduction of mechanical draft. The installation of the fan, which was built by the B. F. Sturtevant company of Boston, and cost less than $600, is said to have brought about an annual saving of $6,500 in the fuel bill.

The latest comers to enter the incandescent-lamp field are Goodchild & Welsh of Newark, N. J. This firm's factory is equipped with modern machinery and has a capacity for turning out about 2,000 lamps a day. They claim that their new lamp is worthy the attention of careful buyers and request that samples may be submitted to intending purchasers. Mr. Goodchild recently severed his connection with the firm of McLaren & Goodchild in order to enter the new firm. He will look after the outside interests of the concern and handle the output. Mr. Welsh, who has been for about 10 years and until recently employed in the General Electric company's lamp department, will do the expert work for the firm and attend to the production of the lamps. His long experience with the General Electric company is said to fit him especially for this important branch of the business.

The Chicago Mica company announces that it will shortly move its factory to Valparaiso, Ind., where a large factory has been bought, in addition to seven acres of land. This step was necessary, owing to the constantly increasing business of the company, due largely to the energetic and able management of President M. A. Snider and Secretary W. F. Hatch. As is well known, the Chicago Mica company manufactures everything known in mica for insulating purposes, and has already built up an excellent business among the electrical and street-railway interests. The new factory is fitted with the most modern appliances for the manufacture of its product, and with these increased facilities it is not unreasonable to predict that the company's business will be greatly increased, especially when it is considered that most of the orders thus far secured have come in practically unsolicited. The main office of the company will be in Valparaiso, but large branch offices will be opened in Chicago and New York, and a complete stock will be maintained in those cities.

BUSINESS.

The International Correspondence Schools are offering special inducements to all who enroll before January 1, 1900. As a general inducement a drawing outfit, valued at $12.55, is offered, while to those entering the courses in electrical engineering, telephony or telegraphy an electrical outfit worth $10.45 is given.

The Peru Electric Manufacturing company has completed extensive improvements at its factory at Peru, Ind., which will greatly facilitate the prompt shipment of future orders. Two new kilns have been built, for either coal or gas, and all of the old kilns have been overhauled and placed in first-class condition. Never in its history has business been as great with this company as it has during the last six months.

The Gregory Electric company, Chicago, one of the largest dealers in second-hand electrical apparatus of all kinds, has just issued a new "bargain sheet." This little pamphlet contains a complete list of everything the company has in stock, and it is said to include many notable bargains. The pamphlet will be mailed to anyone interested. The Gregory company reports that it is doing an excellent business, and in fact is forced to work day and night in order to keep up with the constantly increasing demand for its goods.

The progress William Roche has made with his New Standard dry battery in the last year is gratifying. A little over a year ago Mr. Roche was compelled to double his floor space at 259 Greenwich street, and in March of this year was forced to look around for more suitable and roomy quarters. He secured lease on a large floor at 42 Vesey street which was more than equal to the two floors at his old address. Some four months ago he was compelled to secure another large floor in addition to the first, and now believes he will have to acquire still more floor space. The United States navy, it is said, specifies New Standard dry cells in all requisitions for dry batteries. To meet the demands from his European trade Mr. Roche has recently established an office at 46 Clerkenwell road, London, England, where he requests all European inquiries to be addressed. To enable him to attend more to the manufacture of his batteries he has associated with him in a business capacity Mr. G. M. Walker, for several years with the Electrical World.

The Western Electrical Supply company of St. Louis reports that its trade in line and central-station supplies has been especially gratifying. It says that the demand for its Moloney transformers and A. B. inclosed arc lamps has grown so it can hardly take care of its orders. These are products for which the Western company is exclusive territorial agent, and which it is in position to guarantee in every way. The new all-copper-case A. B. lamp is said to have proved itself to be a success. It is an entirely new departure and seems now to be the only logical covering for enclosed arc lamps. The Moloney transformer is claimed to be a transformer whose copper and core losses are reduced to a minimum and which has extremely close regulation and high efficiency. The company is willing to guarantee these transformers for two years and invites investigation.

The Meter Record Book, published by the Western Electric company, contains 250 sheets, three on the same page and perforated so that they may be torn out. Each form is numbered consecutively. There are four sets of books, numbered from 1 to 4. In Book 1 the forms are numbered from 1 to 250; in Book 2, from 251 to 500; in Book 3, from 501 to 750, and in Book 4, from 751 to 1,000. The meter man marks on the facsimile of the dial with a lead-pencil the exact position of the hand on the meter dial. The form is returned to the office, proper extensions made, and the slip filed for reference. In some instances, where different methods of taking records of meters are used, the man who reads the meters carries a book of this description in his pocket and leaves the record of the meter readings with the householder. The size of the blank in the book is 5½ by three inches and the diameter of the representation of the meter dial is three-fourths inch. The Western Electric company thinks that every central station should be supplied with these meter record books.

The Elbridge Electrical Manufacturing company of Elbridge, N. Y., is now engaged in extending its plant and increasing its line of electrical specialties. A year ago this company was reorganized with the following-named officers: President, F. H. Downey; vice-president, W. R. Templar; secretary and treasurer, A. E. Doman. Mr. Doman took the active management of the business and technical end of the institution. At the time the concern was reorganized the company was manufacturing merely a line of small dynamos and motors. During the year, however, Mr. Doman has been actively at work developing a number of specialties that have already met with a gratifying demand. Among the electrical devices now exploited by the company may be mentioned in particular a new sparking dynamo for gas engines. This machine weighs only 14 pounds, and running at a speed of 1,600, is said to be "just the thing" for service as an igniter for gas engines on small launches, automobiles, etc. The Elbridge company also manufactures a laboratory dynamo, especially suitable for service in schools and colleges. This machine is constructed to deliver either an alternating or continuous current, or both, as desired, and is driven by hand or light power. Another piece of apparatus especially suitable for school or college service is the Model transformer. This converter may be made, by a slight adjustment, either "step up" or "step down;" in a word, both the dynamo and the transformer can be manipulated to give a great range of either alternating or continuous-current effects, or both together. The company has also been developing larger dynamos for lighting service, and recently shipped a 300-light machine into the South, while orders for other large machines of this type are now on hand. The factory in Elbridge, devoted exclusively to manufacturing the company's electrical goods, is a four-story building, and power is secured from a local waterfall. In view of the fact that even with the present capacity it is hard to keep up with orders for certain of the special line of goods produced by the company, an extension is under consideration.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 21, 1899.

637,232. Automatic Fire Extinguisher. Joseph Butcher, Jersey City, N. J. Application filed January 12, 1899.

A thermostat controls an electromagnetic releasing device at the discharge outlet of a water service pipe.

637,234. Warp Stop-motion for Looms. Joseph Coldwell and Christopher G. Gildard, Fall River, Mass. Application filed November 17, 1898.

An electrically operated stop-motion for looms is described.

637,235. Electrical Stop-motion for Looms. Joseph Coldwell and Christopher G. Gildard, Fall River, Mass. Application filed May 18, 1899.

An electrical contact device is described which co-operates with a hollow contact roll in a loom.

637,246. Snap Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing company, Hartford, Conn. Application filed August 16, 1899.

The switch combines a base, a hinged contact carrier, a hinged operating part, shouldered offsets carried by the carrier and operating part, a spring engaging both of the offsets, a lip on the contact carrier, and means carried by the operating part to alternately engage opposite ends of the lip.

637,282. Electric Insulator. Joseph A. Poché, New Orleans, La. Application filed April 17, 1899.

The invention consists of a partition having an aperture, a conductor passing centrally through the aperture, an insulating inclosure formed in a single piece surrounding the conductor, extending through the aperture to predetermined distances on both sides thereof, and provided with openings at the ends for the passage of the conductor, which are plugged up around the conductor in an air and water-tight and electrically insulated condition.

637,290. Telegraph-instrument Key. Charles J. Scheffler and Clarence V. Walls, Newcastle, Pa. Application filed January 7, 1899.

A circuit closer for telegraph keys is described.

637,302. Sparking Igniter for Explosive Engines. George S. Strong, New York, N. Y., assignor to John P. Murphy, Philadelphia, Pa. Original application filed December 15, 1898. Divided and this application filed May 5, 1899.

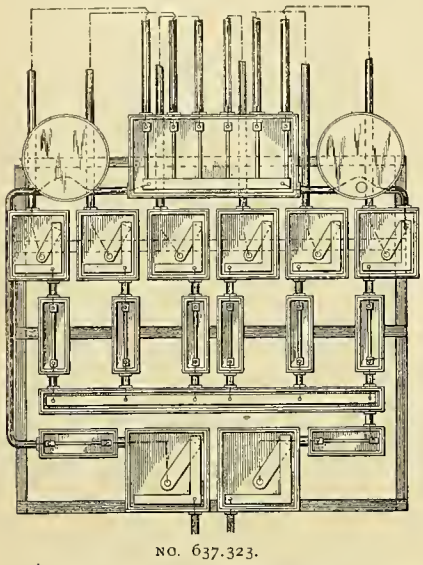
The invention is an electric igniter for gas engines.

637,313. Apparatus for Recutting Files by Electrolysis. Samuel Wicks, Cleveland, O. Application filed July 10, 1899.

In the apparatus there are provided means to support the files singly and separately, means to adjust the files to any depth desired in the electrolyte, cathode members supported and suspended within pockets in the walls of the apparatus, and electrical connections for the files and cathode members.

637,318. Burglar Alarm for Windows. Robert Baumann, St. Louis, Mo., assignor of one-half to Theodore H. Wurmb, St. Louis, Mo. Application filed November 7, 1898.

The alarm is constructed with a casing, a pair of contact heads pivotally arranged in the casing, blocks of insulating material seated in the inner faces of the contact heads, spring tongues arranged to throw the contact heads outwardly and having their ends normally resting upon the blocks of insulating material, and a hand-switch arranged to contact with the spring tongue, one of the terminals of the alarm circuit being electrically connected to the switch, the opposite terminal being electrically connected to the contact heads.



NO. 637,323.

637,321. Electric Massage Instrument. Louis Casper, Chicago, Ill. Application filed May 23, 1899.

An instrument is described which has means for producing massage action, and means for producing an electrical action on the skin through the parts employed for massaging.

637,323. Electrical Switchboard. Charles H. Cox, Liverpool, England. Application filed April 29, 1899.

The switchboard has a series of metallic cases which contain the appliances of the board, a bus-bar divided into sections, each disposed within the case of the appliance which it feeds and having formed upon it a contact piece for the appliance, the sections being electrically connected, and tubes which contain the electrical conductors by which the appliances and sectional bus-bar are electrically connected and which unite the cases one with the other. (See cut.)

637,324. Sheet-feeding Machine. Frank L. Cross, Mystic, Conn., assignor to the Standard Machinery company, Mystic, Conn. Application filed November 30, 1898.

Feeding mechanism and a combing device in the machine are controlled by an electromagnet.

637,337. Railway-signaling Apparatus. Washington Hume, London, England. Original application filed October 6, 1898. Divided and this application filed March 17, 1899.

The apparatus comprises pairs of insulated contact bars spaced apart one behind the other and arranged in sets along the track, corresponding switches located at a signal box or station, electrical connections between each of the pairs of contacts and the switches, audible signaling devices of different tones placed alongside the rails and adapted to be operated by the closing of the circuits between the pairs of contact bars, and one or more circuit-making-and-breaking devices carried by a traveling vehicle, the circuit-making-and-breaking device being adapted to electrically connect and close a circuit between the successive pairs of contacts.

637,341. Program Clock. Harry F. Jordan, Chicago, Ill., assignor of one-half to Albert L. Bentley, Chicago, Ill. Application filed December 12, 1898.

A series of pegs bearing tablets are adapted to be removably inserted in perforations in the front wall of the clock casing whereby an electric alarm is sounded.

637,349. Alternating-current Electric Motor. Conral L. Rosenqvist, Birmingham, England, assignor to Veritys Limited, London, England. Application filed March 31, 1898.

A single-phase synchronous motor is described whose main field-magnet poles are slotted or perforated near the inner edge, and are supplied with two sets of windings, one winding surrounding the whole of each main polar projection, and the other winding surrounding one-half or a part of each of two adjacent main polar projections, combined with means whereby the latter winding is joined in series with the armature winding when the motor is started and replaced by the first-mentioned winding when synchronism is attained. (See cut.)

637,377. Means for Preventing Tampering with Fire-alarm Boxes. Frederick Ely, Newark, N. J. Application filed March 17, 1899.

An electrically operated device is arranged to actuate a lock mechanism when the alarm-box door is opened

637,388. Automatic Weighing Scale. Edward Hanak, Sacramento, Cal., assignor to the Union Scale and Manufacturing company, Sacramento, Cal. Application filed June 13, 1898.

The machine has an electromagnetic trip which operates mechanism in the scale and which is controlled by the scale beam.

637,409. Electric Protector for Buildings. Joseph Poché, New Orleans, La. Application filed April 21, 1899.

There is described a protector for automatically cutting-out the interior wiring in a building from the outside wiring, consisting of the combination with fuses of means for producing a sound by concussion, located in the paths of the means, short-circuiting terminals included in circuit between the fuses and normally separated, and an electromagnetic device of high resistance included in circuit across the main line of the interior wiring for operating the terminals, and a manual device for adjusting the terminals. (See cut.)

637,410. Process of and Apparatus for Dissociating Substances by Electrolysis. Goldsbury H. Pond, Ashburnham, Mass. Application filed March 7, 1899.

The process consists in packing a soluble salt between two vertical electrodes, then feeding a saturated solution of the same salt to the inner face of each electrode, and passing an electric current through the electrodes, packed material and descending film of saturated material.

637,414. Electric-signaling Apparatus for Rail or Tram Ways. Friedrich W. Prokov, Berlin, Germany. Application filed December 30, 1897.

An electromagnet operates a catch lever in the apparatus.

637,422. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed March 2, 1899.

The battery combines a basket, pockets formed against the basket and having walls upon all sides, insulating supporting-blocks retained in the pockets, and a positive element supported on the blocks.

637,448. Electric Arc Lamp. William J. Davy and George Thomas-Davies, London, England. Application filed October 7, 1897.

The construction and arrangement of the frame of the lamp consist of a central-frame tube, a solenoid tube, an upper disk secured thereto, a lower disk bolted to the upper disk, an inclosing ring inclosing the space between the two disks, and a lower yoke secured by yoke-rods to the lower disk and the glass bell, the whole forming a perfectly closed chamber.

637,453. Telephone Transmitter. Ellis F. Frost, United States Army. Application filed August 19, 1899.

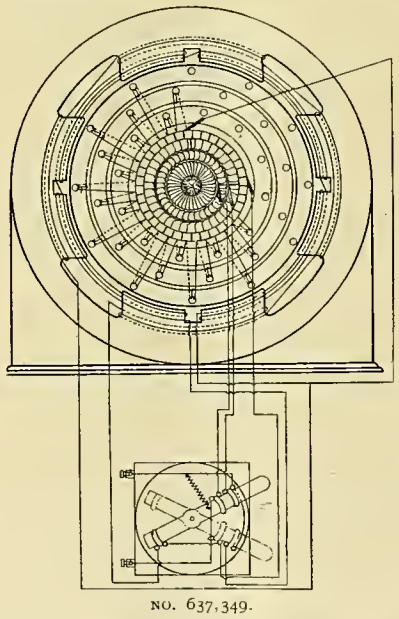
In the transmitter are combined a diaphragm, an electrode mounted thereon, a chamber inclosing the electrode, an electrode therein inclined to the first, and a granular conductor partially filling the chamber and between the electrodes.

637,454. Electric Clock. Fred I. Getty, Chicago, Ill., assignor to the Automatic Electric Clock company, Kansas City, Mo. Application filed September 26, 1898.

Combined with a driven shaft or arbor of the clock train are two levers having pawl-and-ratchet connections with the arbor, an electromagnet having an armature operatively connected with the levers, an energizing circuit for the magnet, and means for making and breaking the circuit at the termination of the downward movement of each lever.

637,457. Electrical House Wiring. Edwin T. Greenfield, New York, N. Y. Application filed March 29, 1899.

One or more electrical conductors are surrounded by a metallic armor, in combination with rigid means of support permanently secured to a wall, ceiling or other surface, the metallic armor being self-compensating for variations in heat and cold.



NO. 637,349.

637,473. Motor-wattmeter for Three-phase Alternating Currents. Julius A. Möllinger, Nuremberg, Germany. Application filed August 31, 1898.

The apparatus consists of two induction motors having inducing coils in series relation each with one of the current mains, and secondary inducing coils connected one to the third-current main and the other to one of the first-named mains, and both to a shunt resistance connected in circuit with the other current main.

637,474. Circuit-breaker. Davis L. Moore, Jr., Philadelphia, Pa., assignor of two-fifths to John E. Gensemer, Philadelphia, Pa. Application filed March 18, 1899.

In the circuit-breaker a motor mechanism controlled by an escapement is combined with means for normally locking the mechanism against movement, a pair of conducting devices, and mechanism adapted to be operated by the motive mechanism when released for throwing the devices out of contact.

637,558. Multicolor Printing. Edward Hett, New York, N. Y. Application filed November 1, 1899.

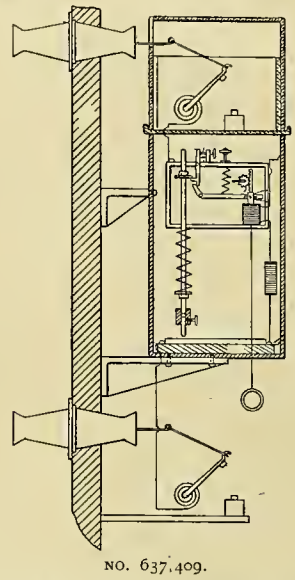
A feature of the invention consists in preparing a series of curved identical tubular metallic bases for printing forms. Each base is revolved in a zinc electrolytic bath, thereby applying to it by electrodeposition a planographic continuous seamless zinc coating of predetermined thickness, integral with the base and suitable to have imposed upon it and to print a design, the coating and its base constituting the printing form.

637,569. Controlling Engine for Presses. Edward Hett, New York, N. Y. Application filed September 8, 1898.

Electric-clutch mechanism is provided for connecting the driving parts of the press with a part to be driven or for disconnecting them.

637,571. Controlling Engine for Presses. Edward Hett, New York, N. Y. Application filed September 8, 1898.

This patent includes an electrical attachment similar to the above.



NO. 637,409.

637,581. Apparatus for Handling Lithographic-printing Tubes. Edward Hett, New York, N. Y. Application filed January 31, 1898.

An electrolytic bath is combined with a tube holder adapted to support a printing tube while receiving an electrically deposited coating in the electrolytic bath.

637,583. Tube-handling Device. Edward Hett, New York, N. Y. Application filed January 3, 1899.

An electric motor operates the carriage and hoisting mechanism of the apparatus.

637,584. System for Handling Printing Cylinders. Edward Hett, New York, N. Y. Application filed January 3, 1899.

The movable carriage of a press is driven by an electric motor.

637,585. Electroplating Apparatus. Edward Hett, New York, N. Y. Application filed January 13, 1897.

The containing vessel of an electroplating apparatus and suitable electrical connections are combined with supporting and revoluble shafts.

637,625. Apparatus for Forming Plates for Secondary Batteries. Henry Leitner, London, England. Application filed June 12, 1899.

The apparatus consists of a box having a rubber lining and a movable end, means for adjusting the movable end against a series of plates arranged side by side in the box, a cover, bottom and side plates having channels for the circulation of an electrolyte, porous separating pieces between the plates, and resilient end cushions which permit expansion of the plates in thickness.

637,635. Mantle for Electric Arc Lamps. Paul Merch, Paris, France. Application filed December 27, 1898.

This invention is a burned mantle for carbon electrodes in electric arc lamps, consisting of a composition of clay, alumina and kaolin.

637,678. Explosive Signaling Apparatus for Railways. William R. Sykes, London, England. Application filed September 13, 1899.

Electromagnets are provided in the apparatus to operate the firing hammer of the explosive device on the passing of a train.

637,695. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed August 10, 1899.

An electromagnet and circuit control the times of operation of the placer and shuttle-box of the loom. The circuit has in it a break, the closure of which is controlled by the weft in the shuttle in play.

637,705. Telemotor Apparatus. Andrew B. Brown, Edinburgh, Scotland. Application filed December 31, 1897.

Combined in the apparatus are transmitting and receiving cylinders and pistons with fluid pipes connecting the cylinders, a rotary shaft operated by the receiving piston, a dial, independently movable indicating arms, and electrically operated means carried by the shaft for operating one or the other of the pointers.

637,711. Driving Mechanism for Dynamos. John L. Creveling, New York, N. Y. Application filed September 10, 1898.

The wheels and axle of a car truck are combined with a dynamo movably supported in proximity to the axle, and means for urging the dynamo toward the axle.

637,753. Loom. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Application filed July 19, 1899.

In the loom electromagnetic means set in operation by the shuttle control the times of shifting the placer and shuttle-box.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, DECEMBER 9, 1899. No. 24

Electric Power Plant in the Chicago Great Western Railway Shops.

By T. E. Stuart.

At Oelwein, Ia., are located the extensive new repair shops of the Chicago Great Western railway or "Maple Leaf Route," this town being the junction point of the three lines which reach to Chicago, to St. Paul and Minneapolis and to Kansas City. These shops have been in process of construction for considerably more than a year, and are in all probability the largest railway-repair shops in the United States west of the Mississippi River. They were formally opened on September 28th, but had been in operation for some time previous.

The shops consist of nine buildings, the more important of these being constructed principally of brick, steel and glass. The machine shop is 720 feet in length by 90 in breadth, with accommodations for 20 locomotives and six coaches, including under its roof the offices, storeroom, machine and boiler shops and the coach shop. There are other buildings for the paint shop, blacksmith shop, freight-car shop (with stalls for freight cars), lumber store, woodworking mill, wheel shop, power station and the lavatory, the last-named being about 48 by 96, with lockers, baths and wash basins on lower floor, the upper being fitted up as a library and clubroom for employes' use.

In the picture on the next page (Fig. 2) is given a view of the shops from across the tracks to the east, the large building on the left being the machine shop. In the center is the transfer table and pit and a derrick for unloading heavy material. On the right is the power station with its smokestack.

Included in the power station are the engine room, boiler room and pump room. In the last-named is a deep-well pump belted to a 10 horse power motor. This pump raises water from a depth of 210 feet to the water tank, seen on the extreme left in Fig. 2. There is also a fire pump and an air compressor, the latter supplying air for small drills, hoists and caulking tools.

In the boiler room three Stirling water-tube boilers supply steam for the generating equipment in the engine room, which consists of three 100-kilowatt, 220-volt Crocker-Wheeler direct-current generators, connected by the Arnold system to two tandem-compound Ideal engines. The engines and generators are shown in Fig. 3. The larger of these engines has cylinders 14 by 22 by 16 inches, and ordinarily drives two of the generators, the other generator being driven by the smaller engine. The latter engine is arranged, however, so that by admitting live steam at reduced pressure to the low-pressure cylinder it will operate two generators at full load, the armatures of the generators being on quill shafts and provided with flange couplings, so that changes in the engine connection may be made. This arrangement of engines and generators is practically equivalent to three separate direct-connected units of the same capacity in providing against breakdowns, while the first cost is considerably reduced. The plant was designed and installed by the Arnold Electric Power Station company, whose contract covered also the heating, lighting and water supply and compressed-air system.

The switchboard (Fig. 4, p. 337) is of black, polished slate, with one feeder and three generator panels. Each generator panel is provided with voltmeter, ammeter, circuit-breaker and double-pole, double-throw switch, the double-throw being provided so that any one of the generators may be put on the lighting load to prevent fluctuations in the lights caused by the change in load on the motors. On the feeder panel are five feeder circuits and a voltmeter and ammeter, the latter having shunts in each feeder circuit and a switch, so that readings can be taken of the current supplied to any one of the feeders.

Fig. 5 shows a battery of six motor-dynamos which are operated by current from the switchboard and are being used to supply current to the lines of the Postal Telegraph-cable company. The small direct-connected generator shown in Fig. 6 supplies current for operating these machines on Sundays and at other times when the large generators are idle.

There are in the various shop buildings 31 motors, ranging in size from 2½ to 60 horse power, for driving the shafting and various other applications of power. In the machine shop, of which an interior view is given in Fig. 1, the shafting is driven by two motors of 20 horse power each and one of 10 horse power. The pit side of the shop is spanned by two cranes, a traveling crane of 15 tons' capacity and a locomotive hoist of 65 tons. The latter is provided with motors for hoisting only, the bridge traverse being performed by hand, and for trolley traverse the hoist is coupled to the traveling crane.

The shop is heated by hot air. The two large fans for supplying it are each driven by a 25 horse power motor.

FIG. 1. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS.—VIEW IN MACHINE SHOP.

A 10 horse power motor in the boiler shop is used to drive the blower for forges and an exhauster for removing gas and smoke. A freight elevator in the coach shop is also operated from the shaft driven by this motor. In the storeroom is another freight elevator, which is likewise driven by a motor of 10 horse power.

The transfer table runs in a pit parallel to and extending the whole length of the machine shop. The table is driven by a "G E 52" motor, current being taken from a pair of overhead trolley wires which span the length of the pit. Near the east end of the pit is the derrick, which is used in handling wheels and loading and unloading heavy material, the motor for operating it being of 25 horse power.

In the woodworking mill the greatest amount of power is used, it requiring one 10 horse power, three 30 horse power and one 60 horse power motors to drive the shafting and one of 35 horse power to turn the exhauster which removes the dust and shavings. Each machine is piped for the exhaust, and the shavings are carried overhead through a large pipe to the boiler room and delivered direct

under the boilers. This creates quite a saving in fuel and also does away with this waste material, which would otherwise block up the shop, accumulating so rapidly at times that it would be a problem to remove it.

The wood-mill and freight-car shop are heated by the hot-blast system, a 10 horse power motor driving the fan in each building. These motors are arranged so that they may be run in series to reduce speed when the weather is mild or when less heat is required. The two 25 horse power motors in the heating plant of the machine shop are also arranged in the same manner.

In the blacksmith shop it requires a motor of 25 horse power to drive the blower fan and exhauster, and one of 10 horse power operates a bolt-heading machine and a combined punch and shear.

Of the other motors, one in the wheel shop, of

FIG 2. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS.—MACHINE SHOP, TRANSFER TABLE AND POWER HOUSE.

20 horse power, drives shafting; another, of 2½ horse power, in the lavatory, is connected to a ventilating fan, while a 10 horse power motor in the ice house is used for raising ice for use in the refrigerator cars.

The roundhouse will be supplied with power through a cable of 500,000 circular mils when the line is completed. A coal chute is under process of construction, the conveyors in which will be driven by a motor. A 10 horse power motor will also be installed in the roundhouse for operating a pump and for driving some machine tools which are to be installed. A motor for operating the turntable is also contemplated, as the heavy engines require 10 or 12 men to move the table when the engine is run on.

All buildings of the road, depot, freight house, roundhouse, yards, etc., as well as the shops and shop yards, will be electrically lighted when the wiring is completed, requiring over 900 incandescent and 57 arc lights for this purpose. The arc lamps are all of the enclosed pattern, about one-third of the number being 220-volt lamps, while the remainder are operated two in series across the 220-volt circuit.

The electric lighting of the switch lamps in the yards by incandescent lamps is also contemplated, the problem of wiring, however, presenting something of a difficulty.

This installation is peculiar in that one difference of potential—220 volts—is used for all purposes. With a 220-volt incandescent lamp of an efficiency equal to that of the 110-volt lamp and a suitable cut-out for use on 220-volt circuits, there would be no fault to find with its use, as the saving in copper is a great advantage over the 110-volt system.

Postmaster-general Favors Automobiles.

In his annual report the postmaster-general recommends an appropriation of $500,000 to develop the pneumatic-tube service, which, he states, has given entire satisfaction wherever tried. In regard to automobiles he says: "A practical test is about to be made in Chicago to determine the feasibility of transporting the mails between the main office and branch postoffices by automobiles. In view of the prominence which these vehicles have recently attained in the development of the means of general transportation, it is believed that the time has come for utilizing them in connection with the carrying of the mails. If the test in Chicago shall prove favorable, automobiles will doubtless be introduced in some other cities for the purpose of carrying the mails between postoffices, branch offices and railroad stations, as it is probable that time can be saved and better results obtained from a vehicle of this kind than from the ordinary regulation or screen wagon."

Better to preserve street pavements, particularly asphalt, the Chicago City Council recently passed an ordinance requiring grooved rails for street railways. Five years are given the companies for the installation of modern rails where the old-style flange rails are now, but whenever a new track is laid or a new pavement is put down the grooved rails are to be installed at once and the pavement between the tracks made uniform with the remainder of the surface.

Electrical Eyes.[1]

By G. H. Robertson, F. C. S.

Many readers of the Electrician may have noticed articles under the above heading, or a similar one, which appeared in various newspapers some two or three months ago, and possibly they may have felt curious to know a little more about Mr. Stiens' work. It is not the first time that an attempt has been made to give sight to the blind, or to find a substitute for the human eye; and it will be remembered that two or three years ago Mr. Edison proposed to utilize the X-rays for this purpose, although it is a little difficult to understand how rays, which are useless for purposes of vision to those whose sight is perfect, could possibly be of use to those who have lost their sight. Further, the physiological action of the rays is known to set up inflammation under certain conditions, and it seems that there would be some danger of causing inflammation of the optic nerve if it were exposed to the action of these rays when not protected by the lens of the eye, as it is in the case of a normally healthy person. Mr. Edison did not hope to be able to do more than show the shadows of objects to the blind, but Mr. Stiens is more ambitious in his ideas, for, according to a representative of the Daily News who interviewed him, Mr. Stiens has succeeded in constructing an electrical apparatus which forms an efficient substitute for the eye itself. But here it will be best to quote from this newspaper's report, because the results recorded are rather surprising.

Mr. Stiens is described as a Russian scientist and a doctor of philosophy, but the university at which he obtained his degrees is not given; and then we are told that, in response to the question, "You say you will make the blind to see?" Mr. Stiens replied: "Absolutely. . . . I give artificial sight, and it makes no difference whether the person was born without eyes, whether the eyes have been wholly or partially destroyed since birth, or how the sight has gone. . . . My apparatus will, as in the camera, focus the rays of light from the object to the brain, and sight is given, the objects being clearly seen, not inverted, but in their proper form. My apparatus constitutes a substitute for the lens. . . . So long as the receiving part—the brain—is there, my apparatus will do the rest. The rays of light strike my apparatus instead of the eyes, and pass thence to the brain, the real camera. And the apparatus will be effective carried anywhere, so long as it is connected with the body, the nearer the brain the better." The interviewer was then asked by Mr. Stiens whether he would like to test the apparatus, and eagerly replied in the affirmative, whereon he was taken into a small room and "effectually" blindfolded. "I could see absolutely nothing. Matches and candles were lighted before me, but I could not see them. Then I was connected with his apparatus. I felt a slight sensation of an electric current passing through my body. Then quickly the darkness passed away, a dull gray took its place, and was succeeded by a bright light. I saw fingers held up before me, and a disc that looked like a coin. And when I was disconnected from the apparatus I found I was standing just where I was when the eyes were bandaged. Mr. Stiens had been by my side all the time, and there was no one else present." The inventor would not permit any examination of the apparatus, as the patents for it have not yet been applied for, nor would he explain the precise character of his invention, or the means employed to achieve such results, but he claimed that the apparatus performed all the functions of the eye, and was a substitute for it.

Now, as I myself have been blind some six years, I was naturally interested by this account of Mr. Stiens' achievement, and as a first step toward putting myself in communication with him, I wrote to the editor of the Electrician to ask for the address of Mr. Stiens, who was described in the interview just quoted as an electrical engineer who had been working for some years in this country. The editor did not know the address, however, and suggested that I might obtain it from the editor of the Daily News, and that I should then arrange for an interview on behalf of the Electrician. At the same time he offered that one of his staff should accompany me. On applying to the editor of the Daily News, he kindly favored me with the following reply: "October 12th. The manager of the Daily News writes to inform Mr. Robertson that he has no knowledge of Mr. Stiens, save that his address is Marion Villa, Padua road, Penge."

I wrote requesting an interview, but as over a week elapsed without my receiving any reply, I called on Mr. Stiens at Penge on Friday, October 20th, accompanied by a member of the staff of the Electrician. Mr. Stiens excused himself for not having replied to my letter by stating that he was overburdened with correspondence since the publication of his discovery, and he regretted very much that he could show us no experiments then, as his apparatus was not at Penge, but in a laboratory which had been placed at his disposal. He said the report in the Daily News gave an accurate account of what had occurred at the interview which he had with its representative. He was an experimentalist who experimented on "zee blinds," and he would be most happy to give us a demonstration of the results he had obtained. But it must be on some other occasion, as he had had no sleep for two nights, owing to his having been engrossed with his experiments; and as he scarcely knew what his engagements were then, he said he would make an appointment by letter. After some further conversation, in the course of which he alluded to some marvelous results he had obtained by a new method of wireless telephony, we took our leave, Mr. Stiens courteously escorting us part of our way to the station.

Days went by, and the promised appointment was never made, so on Saturday, November 4th, having announced our intention some days beforehand, we

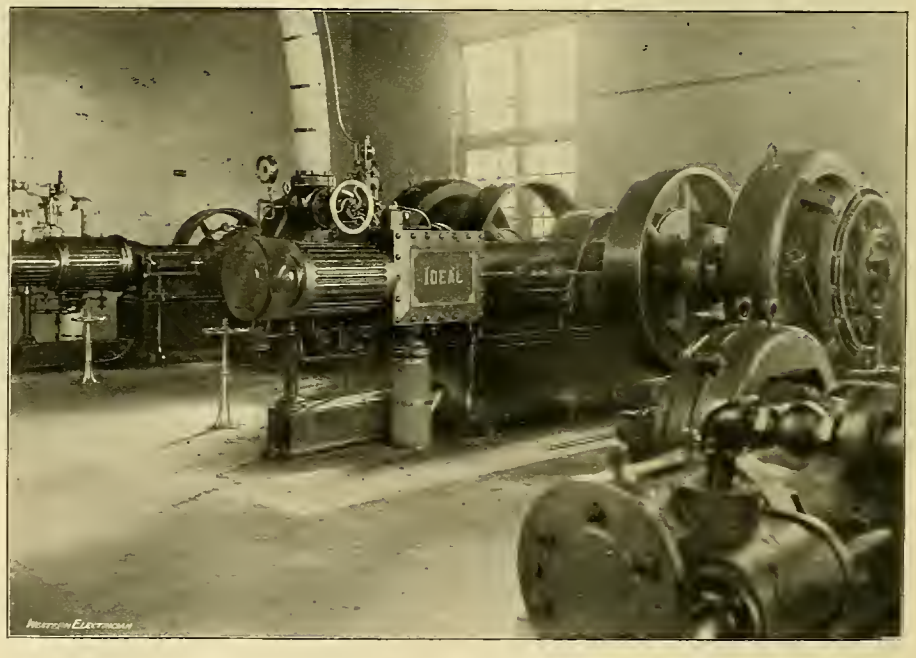


FIG. 3. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS.—ENGINES AND GENERATORS.

1. From London Electrician.

called on Mr. Stiens at the laboratory in which he stated he had been working. He regretted that he was again unable to give us any demonstration, as he had, he said, removed his apparatus to his house at Penge on the previous day. However, he told us that he had been successful in making a young lady, who had been blind five years, see the light of a lamp which he showed us, and that since then she had had some sense of light. The lamp in question was an ordinary continuous-current open arc lamp, and as the room was very small, it is not surprising that she did receive some sense of light from the lamp. I myself had a similar experience, more especially when a red glass was held in front of the lamp; but I put this down to the penetrative power of the red rays, and the subsequent flashes in the eye I attribute to the irritation caused in the optic nerve by the intense light. Mr. Stiens

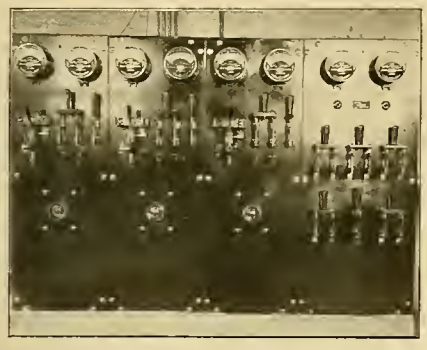
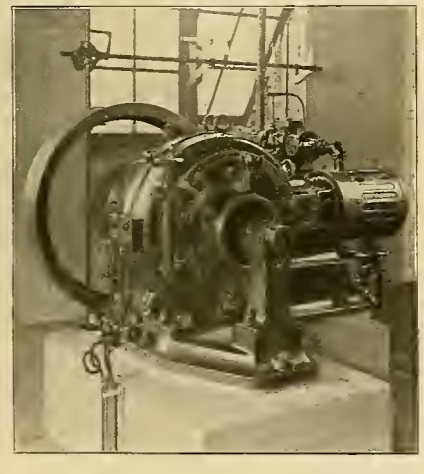


FIG. 4. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS —SWITCHBOARD.

appeared perfectly satisfied with the result of the lamp experiment, and again promised to show us what could be done with his apparatus; but, as before, he failed to make any appointment, although we expressed our willingness to meet him when and where he liked. Accordingly, on Monday, November 13th, I wrote to inform him that, unless the long-promised interview was afforded me on or before November 18th, I should be obliged, as I am doing now, to publish the record of my attempts to obtain a demonstration of the powers of his apparatus. Mr. Stiens has subsequently stated to a representative of the Electrician that since the date of our first visit to him he has, within a week, had no less than 70 blind people at the laboratory, and that in each case the person was able to see him before he left his laboratory. He further stated that he was to be visited by Dr. Campbell (of the Royal Normal College for the Blind) and some of his pupils on Tuesday, November 21st. I wrote to Dr. Campbell asking for confirmation of this statement, and received the following reply: "November 19th. I do not know anything about the tests to which you refer. I certainly have not promised to have any meeting with the gentleman referred to." In face of this reply, and of Mr. Stiens' failure to afford any experimental proof in substantiation of the very remarkable claims which he allowed to be put forward on his behalf in the



IG. 6. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS.—AUXILIARY ENGINE-DYNAMO FOR TELEGRAPH SERVICE.

columns of the Daily News, I think the only conclusion to be drawn is that these claims are as groundless as his statement that Dr. Campbell had made an appointment with him.

It may be thought that I have taken unnecessary trouble to prove what ought to be a self-evident fact—namely, that a substitute for the human eye has not been constructed at the present time; and even were it constructed, the connection between it and the sight center in the brain could not be established, because it could not be connected to the optic nerve, which is a highly specialized structure, and there is no recorded instance of any other nerve having ever taken up its function, although blindness frequently arises from injury to this nerve, the eye itself and the receiving center in the brain being healthy. It is impossible to cause any union to take place between the living tissues of the body and any foreign substance; and unless such union could be effected, the impressions received by any artificial eye, electrical or otherwise, could not be transmitted to the brain by the optic or any other nerve. This fact alone ought to have been sufficient to prevent credence being given to Mr. Stiens' reputed discovery. However, so much weight is attached to statements which appear in the columns of the leading daily papers, that I have heard of at least one blind person whom the report in the Daily News has led to believe that an artificial substitute for the eye was an accomplished fact, and that the requisite apparatus, if not actually already on the market, would at any rate be obtainable soon. Moreover, different friends have called my attention to Mr. Stiens' reputed invention in the hope that it might be of benefit to me, and so I determined to try to find out what foundation there was in fact, if any, for the statements which had appeared in the press. The publication of unfounded reports that cures or remedies have been found for blindness or deafness causes a great deal of unnecessary pain to the relatives and friends of the deaf or blind; for although I doubt if the persons themselves ever believe that the lost sense can be restored, their friends always hope against hope that something may be done. It is therefore most important that any claim of this nature should be thoroughly sifted before it is given to the world. There is also the danger that reports which have appeared in influential papers may be utilized by quacks for their own purposes, and these two reasons must be my excuse for treating Mr. Stiens' pretensions at such length.

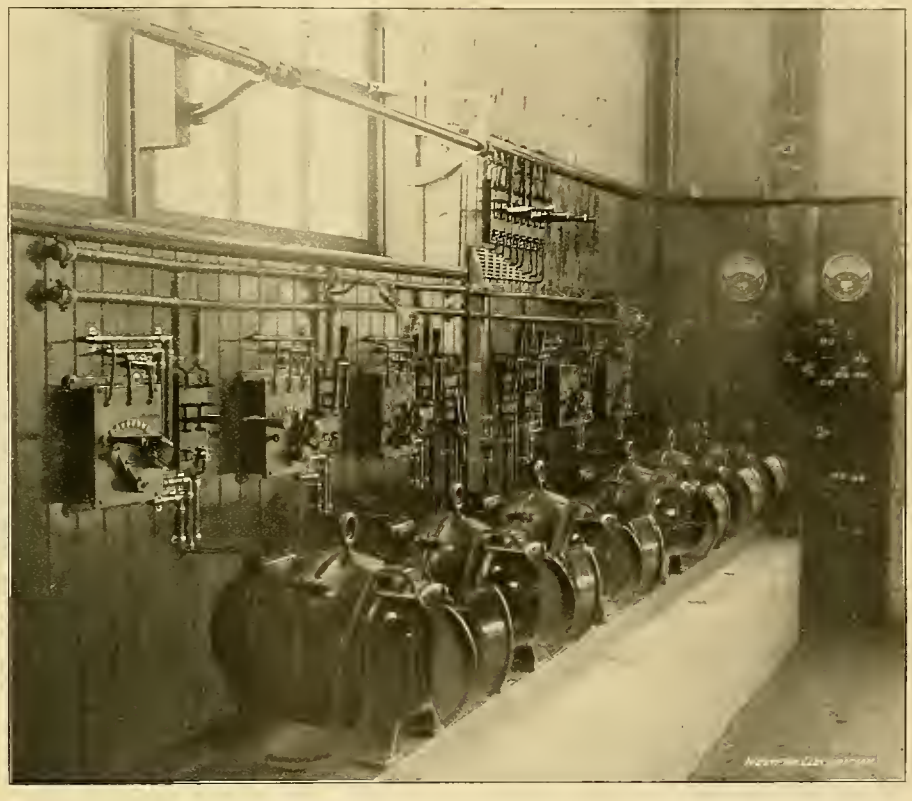


FIG. 5. ELECTRIC POWER PLANT IN THE CHICAGO GREAT WESTERN RAILWAY SHOPS —MOTOR-GENERATORS FOR TELEGRAPH SERVICE.

Advance in the Price of Leather Belting.

A new price-list of leather belting was adopted by the Leather Belting Manufacturers' association in New York on November 15th. The following prices from this list will give an idea of the revised schedule: Single belting one-half inch wide, eight cents a foot; one inch wide, 14 cents a foot; two inches, 34 cents; four inches, 72 cents; six inches, $1.11; eight inches, $1.48; one foot wide, $2.22; two feet, $4.44; three feet, $6.66; four feet, $8.88; five feet, $11.10; six feet, $13.32. Double belting is twice the price of single belts. In a circular accompanying the new price-list the Chicago Belting company says: "For some time past leather-belting manufacturers have been suffering a loss, owing to the continued high price of raw hides and other materials used in the manufacture of leather belting. We have foreseen that something must soon be done in order to relieve this tension. The rough-leather market of to-day is and has been stronger than ever in the past, and belting butts have advanced over 33 1-3 per cent. within the last year. The list adopted to go into effect on and after November 20th is, we think, a very fair and equable one, and the advance made therein on the smaller sizes really only covers the advance of rough leather within the last 10 days."

Electricity or Steam for Railroads.

Members of the American Society of Civil Engineers have lately devoted much attention to the place of electricity and steam in railroad service. In the November issue of the proceedings of that society Mr. C. H. Davis treats the subject at length and reaches these conclusions:

(1) Steam railroads will, in the near future, handle their suburban and short-distance interurban passenger traffic and mail, express, baggage and light local freight carried in said suburban and interurban passenger trains, by electric motive power; and this, irrespective of whether operating expenses are affected favorably or unfavorably.

(2) Steam railroads will not, in the near future, handle their freight traffic (other than mail, express, baggage and light local freight carried in suburban and interurban passenger trains) and long-distance passenger traffic by any other motive power than steam locomotives.

(3) Steam railroads may, under exceptional conditions of large volume and great density of passenger traffic over comparatively short distances, handle it by electric motive power, but such cases will be infrequent.

(4) New railroad lines, connecting very large centers of population, where frequent service at much higher speeds than can be attained now by steam locomotives on existing lines is a condition of success, will be operated by electric motors.

There are three conditions under which suburban and short-distance interurban traffic will be handled profitably by steam railroads converting to electric traction:

1. (a) Where units can be light and frequent, and operated over comparatively short distances.

(b) Where gross receipts can be so increased by the change of system and mode of operation as to pay for the increased investment and possible increase in operating expenses.

(c) Where competition of parallel electric roads compels the change, to save what traffic there is, irrespective of how operating expenses are affected.

In the future development of steam-railroad systems they will eventually be operated jointly with surface electric railways, either through actual mutual ownership, or by traffic contracts, leases, etc.

The above conclusions are obviously dependent upon what Mr. Prout properly defines as "traffic conditions," and not primarily engineering details or operating expenses.

Increase in Electrical Exports.

The total shipments of electrical machinery (using the term according to the Treasury Department classification) from the United States, during the month of October last, amounted to a value of $363,773, as against $286,818 during the corresponding month of 1898. For the ten months ended October 31, 1898, the shipments of electrical machinery from this to foreign countries were $1,939,474, increasing this year to $2,454,510.

The Superior street and Payne avenue cable lines of the Cleveland (O.) City Railway company will be converted into electric roads next spring.

Large Alternating-direct Electric-railway System in Central Indiana.

A few months ago there was incorporated the Union Traction company of Indiana, having its main office at Anderson, Ind. This company has absorbed the local street-railway lines operating in Anderson, Elwood, Marion and Muncie and is now engaged in building additional roads, which, when completed, will form a system of electric-railway lines in Grant, Madison, Delaware, Hancock and Marion counties, extending from Indianapolis north to Marion, east to Muncie and west to Elwood, covering in all nearly 140 miles of track. The interurban lines will radiate from Anderson, where will be located a power house that will supply current for the entire system.

In the accompanying map (Fig. 1) is shown the extent of the Union Traction company's lines already built or now under construction, and the cities, towns and counties through which the roads will pass. As indicated by the heavy full lines the part of the system now in operation extends from Anderson north through Linwood, Alexandria, Summitville, Fairmount, Jonesboro and Gas City to Marion, a distance of 34 miles, with a 10-mile branch west from Alexandria through Orestes to Elwood. Of the roads proposed and under construction (indicated by broken lines) an eastern branch will pass from Anderson through Chesterfield, Daleville and Yorktown to Muncie. From Daleville a four-mile

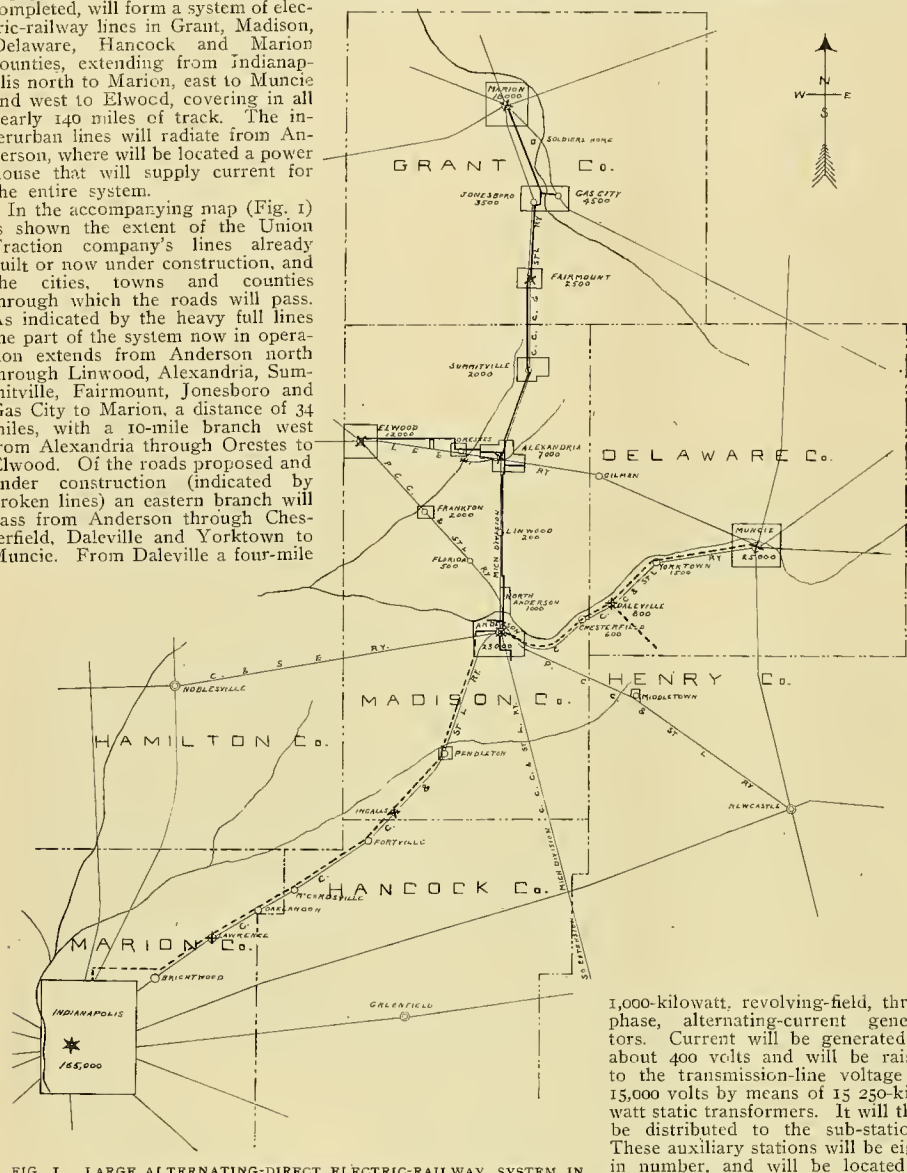


FIG. 1. LARGE ALTERNATING-DIRECT ELECTRIC-RAILWAY SYSTEM IN CENTRAL INDIANA.—MAP OF ROUTE.

branch will extend southeast into the country, touching a number of small villages. The longest line radiating from Anderson will be that to Indianapolis. It will be 35 miles in length and will touch Pendleton, Ingalls, Fortville, McCordsville, Oaklandon, Lawrence and Brightwood en route. Entrance to the center of the capital city will be over the lines of the Indianapolis Street Railway company. In nearly every case the interurban lines parallel steam roads, and the Union Traction company will consequently enter into direct competition with the railroad companies. In the larger cities local lines in addition to the trackage of the interurban roads will be operated.

Following are the lengths of the lines of the system: Anderson to Indianapolis, 35 miles; Anderson to Muncie, 18 miles; Anderson to Marion, 34 miles; Alexandria to Elwood, 10 miles; Daleville branch, four miles; Muncie local, 10 miles; Anderson local, six miles; Marion local, 10 miles; Elwood local, four miles; Gas City local, two miles, making a total of 101 miles of suburban lines and 32 of local lines, or a total mileage of 133. This is all single track, with the exception of two miles in Anderson and the same distance in Marion, which are now being double-tracked.

The supplying of all the power by which the system will be operated from one central power plant will be one of the most interesting features of the road. Alternating current will be generated at the power house in Anderson and will be distributed to sub-stations at nearly equidistant points along the lines, where it will be converted to direct current and distributed to the road in the ordinary manner. In the power house (the architect's design of which is represented in Fig. 2) will be located six 400 horse power boilers of the Babcock & Wilcox make. As Anderson is situated in the gas region of Indiana, natural gas will be used for fuel. The engines specified are three in number, of the cross-compound, horizontal, Corliss type, capable of developing about 1,500 horse power each. They will have cylinders 26 and 58 inches in diameter, with a 48-inch stroke and will operate it 100 revolutions a minute. The Rice & Sargent Engine company of Providence has the contract for furnishing the engines. Air pumps and condensers of the Blake vertical-jet type will be installed.

Direct-connected to the engines will be three 1,000-kilowatt, revolving-field, three-phase, alternating-current generators. Current will be generated at about 400 volts and will be raised to the transmission-line voltage of 15,000 volts by means of 15 250-kilowatt static transformers. It will then be distributed to the sub-stations. These auxiliary stations will be eight in number, and will be located at Muncie, Marion, Alexandria, Fairmount, Elwood, Daleville, Ingalls and Lawrence. At these stations the current will be stepped down to about 380 volts by static transformers and changed to direct current at 550 volts by rotary converters. The rotaries will be 250-kilowatt machines. Muncie, Marion and Alexandria will each have two rotary converters, while each of the other sub-stations will have but one. At the power house in Anderson there will be located three 250-kilowatt rotaries. These will take their current direct from the alternating-current generators and will feed the lines in the immediate vicinity of Anderson. All of the generators, transformers and rotary converters have been contracted for with the Westinghouse Electric and Manufacturing company.

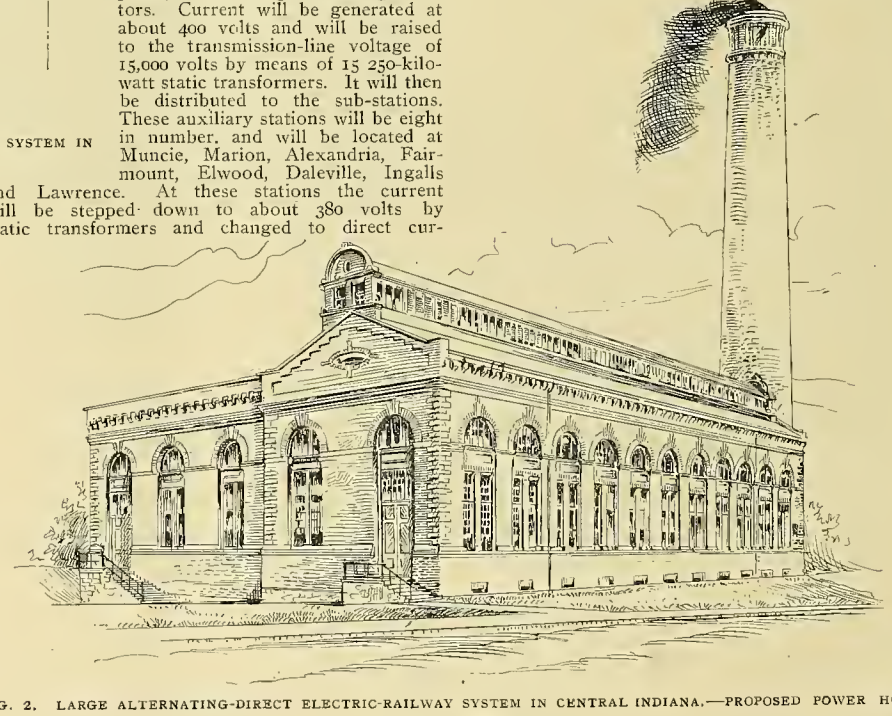


FIG. 2. LARGE ALTERNATING-DIRECT ELECTRIC-RAILWAY SYSTEM IN CENTRAL INDIANA.—PROPOSED POWER HOUSE AT ANDERSON.

At each of the sub-stations and also in the power house there will be located a storage battery, which will be connected in parallel with the rotaries, so as to equalize the load. These batteries will be furnished by the Electric Storage Battery company. At each of the five smaller sub-stations the battery will consist of 264 cells, each cell containing nine type F plates, 10½ by 10½ inches in size, giving a capacity of 85 kilowatts on an hour rating. The three larger sub-stations will each have 264 cells, with nine plates of the type G, 15½ by 15½ inches in size, in each cell, the capacity being 170 kilowatts. At Anderson 264 cells will each contain 11 type G plates and give a capacity of about 200 kilowatts. All of the sub-stations will have differential boosters run in series with the batteries, so as to keep the load on the rotaries as nearly constant as possible.

In the construction of the road none but high-grade material will be employed. Seventy-pound T-rails will be used for the most part, girder rails being laid where required in the cities. All of the bridges will be of steel. The sub-stations, as well as the power house, will be substantially built of brick. Car barns are to be located at Elwood, Muncie, Marion, Anderson, Alexandria and at a point on the Indianapolis line, while the general repair shop will be in Anderson.

All of the work of construction is being done by the Union Traction company of Indiana, Sargent & Lundy of Chicago acting as the consulting engineers. It is expected that the entire system will be in operation next summer. The officers of the Union Traction company of Indiana, which has a paid-in capital stock of $4,000,000, are the following-named gentlemen: President, Philip Matter; vice-president, J. A. Van Osdol; secretary, manager and purchasing agent, C. L. Henry, Anderson, Ind.; superintendent, C. Berry.

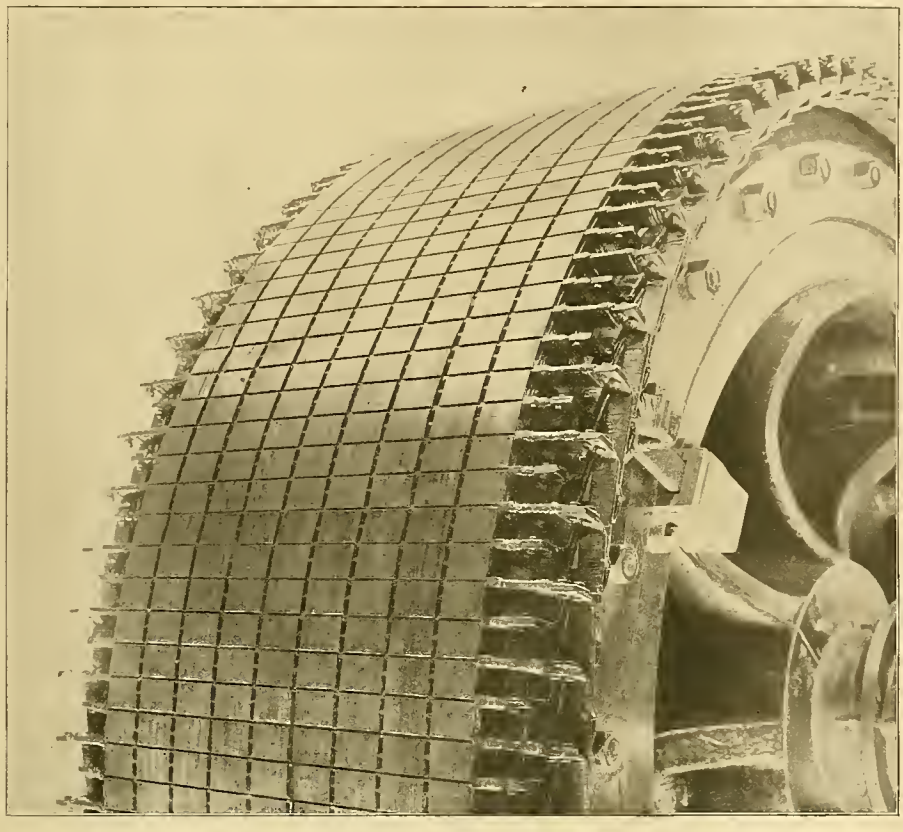
Council Committee Recommends Lease of Drainage Canal Water Power.

The special committee of the Chicago City Council, selected by Mayor Harrison, to consider a contract with the trustees of the sanitary district for the use of the water-power in the Chicago Drainage Canal at Lockport, reported December 4th in favor of a long-term lease. It is proposed to use the power to operate the pumping stations of Chicago, and to direct the surplus power to lighting the streets with electricity. About 16,000 horse power, it is estimated, could be available for use in the city. The committee proposes that the water fund of the city be bonded to pay the cost of installing the plant, building the raceways at Lockport and erecting the transmission lines of the system. The cost is estimated at $3,000,000, but one-half is to be returned in rentals to the lessee by the sanitary board. It is reported that certain persons are bringing influence to bear on the trustees of the sanitary district to readvertise for bids, believing that a better offer than $5 a horse power a year could be made. That is the offer made by Clarence Buckingham, acting for the Diamond Match company, for use of the power for a term of 50 years. It was the opinion of the members of the committee that the sanitary board should accept an offer of $4 a horse power from the city. However, if the city could not do better than a $5 contract for 50 years, it was felt to be the part of economy to accept on the strength of a probable renewal of the contract. The recommendation was made a special order for the next council meeting.

Jacques-Cartier Water-power Plant.

A new electrical power plant of a highly interesting nature is rapidly approaching completion at St. Gabriel, P. Q. Most of the Canadian electrical plants secure their power from stupendous waterfalls, such as that at Niagara, but the Jacques-Cartier Water Power company utilizes a fall of 30 feet only in the St. Gabriel River, which occurs in a rapid 200 yards in length. The electric current to be generated will be transmitted to Quebec, 18 miles distant, at 20,000 volts, and there applied to lighting and power purposes.

A dam, 300 feet in length, of stone foundations and abutments, with a wood superstructure, has been constructed near the head of the rapids. A penstock carries the water for a distance of 200 feet below the dam to the power house, which has been built in a depression near the river.



ARMATURE OF 750-KILOWATT GENERATOR FOR JACQUES-CARTIER WATER-POWER PLANT.

Some months ago the International Hydraulic company of Montreal contracted with the Westinghouse Electric and Manufacturing company for a complete electrical equipment, which is now in course of erection at St. Gabriel. Two 750-kilowatt Westinghouse, three-phase, alternating-current generators will be direct-connected to water-wheels. The generators are wound for a normal electromotive force of 2,000 volts and a frequency of 7,200 alternations a minute, when run at a speed of 150 revolutions per minute. The arrangement of circuits is so designed that the two generators may be run in parallel, as well as independently. They are guaranteed to run continuously for 24 hours at their normal output of 750 kilowatts, with a rise in temperature not to exceed 35 degrees Centigrade above the temperature of the surrounding air, and also to run continuously for 24 hours at 938 kilowatts output, with a rise in temperature not to exceed 45 degrees Centigrade. The armatures are so constructed that individual coils, or group of coils, may be readily replaced, and the armature, as a whole, is accessible for cleaning and inspection without requiring the use of a crane. The terminals of the armature circuits have been especially insulated and protected against risk of contacts. The detail construction is shown in the illustration. The insulation of the armature is such that it is capable of resisting, between the copper conductors and the iron core, the application of 10,000 volts of alternating current. The commercial efficiency of each generator is guaranteed to be, at full load, 94 per cent., at three-quarter load 93 per cent., and at one-half load 92 per cent. At 50 per cent. overload the commercial efficiency shall not fall below 93 per cent.

There have been provided for exciting purposes two 37½-kilowatt Westinghouse multipolar generators, of 125 volts, at 350 revolutions per minute, direct-connected to smaller water-wheels. Each of these machines is designed to fully excite the fields of both generators when they are developing 938 kilowatts each, at a power factor of 90 per cent. When running at full rated load continuously, the temperature of the exciters, at any part except the commutators, shall not rise more than 35 degrees Centigrade above the temperature of the surrounding air.

The transformer room runs the entire width of the power house, having a depth of 24 feet 10 inches, and will contain six 250-kilowatt, Westinghouse self-cooling, oil-insulated transformers, to raise the 2,000 volts from the generators to 20,000 volts, three-phase, at a frequency of 60 cycles a second. The transformers are designed to run at their full normal output continuously for 24 hours, with a rise of temperature in any part not to exceed 45 degrees Centigrade above the temperature of the surrounding air.

Two generator panels, two circuit panels and one exciter panel make up the switchboard. The board is to be mounted on a gallery which extends from a wall running across the full width of the building, directly in the center of the power house, so that it is placed very favorably with regard to connections with the generators and exciters, reducing to a minimum the length of cables and offering short direct paths, which should greatly facilitate the installation of the wiring. The cables will be run through ducts built in the cement floor. The generator panels carry two automatic alternating-current circuit-breakers, three ammeters, two indicating wattmeters, three single-pole, double-throw washer switches, a rheostat, voltmeter, and the usual field plugs, pilot lamps and brackets, and ground-detector plugs and receptacles. The feeder panels carry two automatic alternating-current circuit-breakers, three ammeters, a polyphase-integrating wattmeter, three single-pole, double-throw washer switches, and the usual pilot lamps and brackets. The exciter panels carry two direct-current ammeters, a direct-current voltmeter, two rheostat hand-wheels, two double-pole, double-throw, washer-type switches, a voltmeter, field-voltmeter plugs and receptacles.

The electric plant will be protected by 12 Wurts non-arcing, metal lightning arresters and choke coils, three to be installed at each end of each of the two three-wire transmission circuits.

The electric current, at 20,000 volts, will be transmitted from the St. Gabriel transformer house to Quebec, a distance of 18 miles, by overhead wires. The line is to be constructed in two distinct circuits, each of three wires, for three-phase transmission, with the three wires of each circuit equally distant one from the others, the spacing being 18 inches.

In Quebec the sub-station to which the transmission lines will carry current will contain four 375-kilowatt, Westinghouse transformers of the oil-insulated and self-cooling type, to step down from 19,000 volts to the voltage required for the distributing circuits. The transformers will be arranged in two groups of two each, connected on the Scott system, to receive three-phase current at the primaries and deliver two-phase current from the secondaries.

Work at the St. Gabriel power house is being rapidly pushed. The water-wheels are already in place and the electrical machinery is in course of erection. It is anticipated that everything will be completed for the transmission of current to Quebec by the first of January next.

New Electric Cab Company in Chicago.

The horse and horseless livery companies of Chicago are soon to have a competitor in the Woods Motor Cab company, which has been incorporated with the secretary of state of Illinois, for the purpose of operating public cabs and carriages with electricity as a motive power. The new company, which is capitalized at $500,000, will have close relations with the Woods Motor Vehicle company of Chicago, which was incorporated a few months ago. It will use exclusively cabs and carriages manufactured by the parent company, and expects to have between 40 and 50 in operation by the end of the year. About 25 vehicles are now completed and will be put into service next week. Additions will be made to the equipment of the cab company as fast as the business and the manufacture of the cabs will warrant. It is expected that within the next six months between 200 and 300 of the vehicles will be put into operation. Five styles of carriages will be used, the larger proportion being hansoms and broughams. Pending the establishing and fitting-up of a large station in the business center of the city, which is now being arranged for, the company will use the warerooms of the Woods Motor Vehicle company at 541 and 545 Wabash avenue for a charging station and for storage purposes.

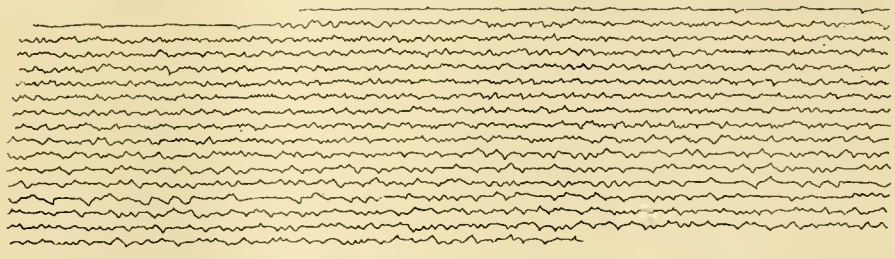
Successful Test of Pollak-Virág System.

A successful test from New York to Chicago of the Pollak-Virág automatic-telegraph system was made on December 3d. A message was sent over wires of the Western Union Telegraph company by way of the Pennsylvania railroad and Pittsburg, by Josef Virág, who was stationed in the New York World office. It was received by Anton Pollak in the Tribune office in this city. The rate of transmission of the message was 65,000 words an hour, and the distance, nearly 1,000 miles, was the longest over which the system has ever been tested. The weather conditions were unfavorable, as it was snowing in Chicago and rain was falling at different points along the route, but still the working of the system was not affected.

At the receiving station the message was flashed on the sensitized paper in the metallic cylinder of the instrument and was later developed by Mr. Pollak. The accompanying illustration is a reproduction of the "photogram," as it is called. Translated the message reads as follows:

This message is the first sent in the United States by the Pollak-Virág automatic rapid telegraph and automatically recorded. It was sent from New York and received in the office of the Tribune in Chicago. The sending and receiving of this were to demonstrate the practical utility of the Pollak-Virág invention in sending and receiving messages at a great saving of time and of telegraph wires. It will be transmitted at a speed of more than 80,000 words an hour, and the receiving instrument will register the words on a photographic sheet as fast as they are sent.

In Budapest, Hungary, where the only other tests of this invention were made, the rate of 150,000 words an hour was attained. Messages will be sent later from the Tribune office in Chicago to New York. This is over a greater distance than has been before attempted. These messages are called photograms by the inventors, because they are recorded photographically by the receiving instrument. The inventors and demonstrators of this system of telegraphing are Anton Pollak and Josef Virág, electrical engineers of Budapest, Hungary.



FACSIMILIE OF POLLAK-VIRÁG TELEGRAPH MESSAGE FROM NEW YORK TO CHICAGO.

In addition to the above message the World sent the Tribune a message saying that New York was having fine weather, and inquiring how it was in Chicago. There will be no further tests of the invention made in this country, as Messrs. Pollak and Virág intend to sail next week for Europe. The financial arrangements necessary to the placing of the system in practical operation are as yet uncompleted.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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There are rumors that the lately incorporated Amalgamated Copper company is not amalgamating—referring now to trade rivals and not to any mining process—with that serenity and completeness which its title might indicate. It is said that three important concerns refuse to be amalgamated—the Calumet and Hecla company, W. A. Clark of Montana and Arizona and F. A. Heinze of Butte, Mont. Failure to secure these large producers will mean that the country must do without an effective copper trust; but the electrical industries can manage to get along without one.

A single contract that provides for electrical machinery having a capacity of over 150,000 kilowatts shows very conclusively that the electrical "infant" of 10 years ago is now at least a well-grown youth among the industries. The order is from the Manhattan Railway company of New York and provides for the generation and various transformations of 50,000 horse power of electrical energy from the steam engine to the line feeders. Aside from its size the contract is noteworthy as showing complete confidence in the recently developed plan of alternating-current transmission and direct-current distribution, both for light and power. Nowadays the alternating and continuous currents are not rivals, but collaborators.

The Westinghouse company is fairly entitled to congratulations on its success in obtaining an order of such unusual proportions.

At last a champion of the telephone pole has appeared. For years this useful upholder of the means of communication has been denounced as cumbersome and unsightly. It has been tolerated for utilitarian reasons, but few persons professed to admire it. But now comes a gentleman in Delavan, Wis., who writes to his local paper to protest against the removal of the telephone poles in a certain street. So far from doing away with the unoffending poles, this intrepid defender of the unappreciated points out that there is room for two or three rows of the poles if required. His only stipulation is that the poles be nicely painted. "Let them alone," says the pole partisan; "they give a business appearance to our city. They show to visitors and outsiders that somebody lives here and is at home." And thus a new argument is given to the telephone man in the small town. The poles will show that somebody lives there and is at home.

Even a lawyer, it seems, is no match for the intricacies of the telephone-toll system as developed by a Bell company. This is shown by a peculiar action brought against the Michigan Telephone company at Huron, Mich., by E. C. Babcock, a legal practitioner. Mr. Babcock alleges that he was called up by telephone from Sanilac Center to defend a prisoner, having been appointed by the court. It became necessary for him to call up Sanilac Center to learn particulars, and accordingly he went into a long-distance booth. The operator refused to connect him until he had deposited 25 cents in the slot. Not having the requisite coin, he went out and returned and dropped the money in the slot. As he had not deposited it at the right time the operator refused to connect him or give him back his money. As a result he lost the client, which would seem to be no great hardship. However, he brought suit for the 25 cents and damages from the loss of the business. The jury rendered a verdict of no cause for action, which would seem to indicate that it thought that Mr. Babcock had bought his experience at a cheap rate.

Courts of law hold electricity in peculiar respect. In a recent decision the Court of Appeals of Kentucky does not hesitate to declare that "electricity is the most powerful and dangerous element known to science." If it is no disrespect to the learned judges to say so, it may be remarked that this is pretty strong language. The court delivered itself to this effect in the case of Schweitzer's administrator against the Citizens' General Electric company, where it reversed a judgment entered for the defendant and remanded the cause for a new trial in accordance with the principles which it laid down. The judges say that it cannot be doubted that electricity is a powerful and dangerous force and a force which no one except experts can understand. The danger incident to electric currents and appliances can rarely, if ever, be foreseen or guarded against by the common citizen; hence, the highest degree of care should be exercised by those using such a deadly and unseen force for private gain. Oh, it adds, seems to be the general doctrine, as found in the books and in the opinions of the courts of last resort, including that of Kentucky. Again, the court says, in the same case, that electricity cannot be seen, and it is as silent as it is deadly; and it follows that those who manufacture and use it for private advantage must do so at their peril. The only way to prevent accidents, where a deadly current is used, is to have protection at those points where people are liable to come into contact with it. And the jury in this case, it holds, should have been instructed that this was the duty of the defendant. To have told it "that it was the duty of the defendant to observe the highest degree of care and skill usually exercised by prudent persons engaged in the same or similar business, to keep its wires so insulated as to be reasonably safe and free from danger to persons who might come into contact with them," was not sufficient. The law, the court insists, requires, at those points where such contact is likely to take place, perfect protection from what is styled "this unseen and terrible power."

There is now but little doubt that the American Bell Telephone company of Boston is to merge its identity in that of the American Telephone and Telegraph (Long-distance) company of New York. The directors announce that they have recommended the amalgamation to the stockholders on the basis of two shares of Long-distance stock for one of the older company. It is likely that the stockholders will accept the recommendation, although it is to be remembered that American Bell stock is distributed among a large number of holders and that the directors do not themselves own a majority.

The passing of the American Bell Telephone company is an event of much interest and significance, although the change is one of name, capitalization and charter privileges, rather than of ownership or policy. It has been evident for some time that the Bell company has been preparing itself for the withdrawal of patent protection, and the fine equipment and large capital of the Long-distance company are indications of the carefully planned intrenchments against competition. To what extent the new Telephone, Telegraph and Cable company of America will enter the field as a competitor of the American Telephone and Telegraph company is not clear. Some of the men who were supposed to have been connected with it have publicly disavowed any responsibility for the company, and the strength of the enterprise is not known, although Mr. Martin Maloney, who is believed to have brought about the organization of the company, seems to be behind it still. Mr. Maloney has the reputation of a shrewd and resourceful financier, and he may accomplish great things with the new company, although it is to be borne in mind that important Independent telephone-operating interests at Baltimore, Pittsburg, Cleveland and other points have not been gathered into its fold.

It should not be forgotten, in considering the situation, that at the present time about 60 per cent. of the parent Bell company's revenue is derived from dividends on its stock holdings in subsidiary companies. Financially, the instrument-rental feature of the business does not cut so much figure as it did, contributing, as it does, only about 30 per cent. of the Bell receipts. In 1892 the average rate charged by the American Bell to its licensees for telephones was $12.17; in 1898 it was about $3. On the other hand, the average rate of dividends from licensee companies rose steadily from 1890 until 1895; the following year it decreased a half of one per cent., while in 1897 it reached the highest figure so far recorded—5.8 per cent.—falling back to 5.5 per cent. in 1898. Thus the importance of the profits of the local companies to the parent organization is clearly shown. Some of the latter, like the Central Union, have not paid dividends for several years. Others, like some of the companies in the Erie group, more fortunately situated in relation to competition or more progressively managed, show increased profits, despite the Independent movement. Of course, as the Independents wax strong, as they are rapidly doing in such cities as Boston, Rochester, Pittsburg, Cleveland, Columbus, Detroit, Grand Rapids, Duluth, Minneapolis, Indianapolis, St. Louis and Atlanta, it is natural to presume that the profits of the Bell licensees will decrease everywhere.

One thing seems to be certain in the telephone situation, and that is that the tendency of rates will be downward for some time to come. The Bell people themselves seem to recognize this fact and are offering various measured-service schemes which will give the customer a reduction or seeming reduction without affecting the net profits of the exchange. As for the rest, it is an intricate game, with or without the patent complication, and, save for the reasonable assurance that there will never again be an unrestricted telephone monopoly in this country, no man can foretell the end of it all.

Physical Effect of Electric Shock.

Messrs. Prevost and Battelli recently presented to the French Academy a resumé of experiments on dogs, rabbits and guinea-pigs with electric currents. In these experiments a condenser was used. It consisted of large plates of glass, the center surfaces being covered with tinfoil. Each plate, measured by a ballistic galvanometer, showed a capacity of 0.16 microfarad. This condenser was charged by a large Ruhmkorff coil. The animal to be experimented upon was included in the circuit, the terminals being placed in the ends of the alimentary canal.

The results of 270 experiments may be summed up as follows:

1. The mortal effects of electrical discharges are not proportional to the quantity.

2. These effects are proportional, as indicated by the experiments, to the energy. In other words, they are proportional to the capacity into the square of the potential.

3. Below a certain limit (about 15 millimeters) the augmentations of sparking distance are not followed by corresponding augmentations of mortal effects. Employing a capacity equal to one and a spark of four centimeters, we obtain approximately the same effects as with a capacity equal to four with a spark of one centimeter. Hence, for obtaining mortal effects it is, within certain limits (about 15 millimeters), more advantageous to increase the potential; beyond that it is more advantageous to increase the condenser capacity.

4. Reversing the poles has no appreciable effect on results.

5. The greatest electrical energy available, about 1,000 joules, was not sufficient to kill a dog weighing between six and seven kilogrammes; a second discharge was also ineffectual to that end.

An electric discharge should have an energy of 900 to 1,000 joules to stop positively the respiration of a rabbit weighing 2,000 grammes, with the electrodes placed as noted. Under like conditions the respiration of a young rabbit was completely stopped. This animal weighed 1,200 grammes and the discharge was of 350 joules.

Similarly, the thoracic respiration was completely arrested by a discharge of 400 joules through a guinea-pig of 500 grammes, by an energy of 250 joules through a guinea-pig of 350 grammes; and by 130 joules through a similar animal weighing 250 grammes.

A comparison of these figures shows that in a general way the energy of the discharge necessary to produce death rises with the weight of the animal; at the same time younger animals are more sensitive than adults.

6. In the case of dogs and rabbits, it is noted that repeated applications of weaker energy will produce the same results as are produced by a single shock of a superior energy; yet, several of these lighter discharges several seconds apart produce less dangerous results than the same amount of energy at one discharge.

7. In a general way we may divide the effects of electrical discharges into five phases, proportional to the energy employed, which varies with the kind and weight of the animal.

First—General muscular contraction without other appreciable effect. In guinea-pigs this requires from 49 to 69 joules.

Second—Clonic convulsions. The respiratory center is not yet strongly affected, and the animal speedily recovers (guinea-pigs, 69 joules; rabbits, 170 joules). In the case of young guinea-pigs death often ensues through lack of pulmonary elasticity, which prevents success with artificial respiration.

Third—Tonic convulsions. Generally momentaneous suspension of thoracic respiration. (Guinea-pigs, 138 joules; rabbits, 250 to 550 joules.)

Fourth—General inhibition of the nervous system. No convulsions; loss of reflex action; absolute stoppage of thoracic respiration. The involuntary muscles are still excitable. The valves of the heart are frequently inactive. (Guinea-pigs, 541 joules; rabbits, 770 to 1,000 joules.)

Fifth—Complete stoppage of the heart; loss of excitability of the involuntary muscles of the intestines; with conservation of excitability of the striated muscles and motor nerves. (Young guinea-pigs only, 750 to 1,000 joules.)

8. The arterial pressure is variable. In the first phase the pressure rises after a previous momentary drop. In the second, third and fourth phases, it usually rises sharply and remains high. This rise shows that the center vasomotor is not paralyzed, while the respiratory center is already affected.

In the third and fourth phases is seen sometimes in the guinea-pig a rise of pressure due to fibrillary tremulations of the ventricles. These are momentary and the heart beats of the ventricles again succeed them, but these beats are usually feeble and the pressure remains.

In dogs the rise of pressure due to the first shocks may be followed by ventricular trembling, when a given energy has been repeatedly administered.

9. Anatomic lessons observed have been: Loss of pulmonary elasticity, most serious in young guinea-pigs; congestive phenomena with pulmonary œdema; pleural ecchymosis, especially when respiration has become difficult without positive cessation.

Rigidity of the cadaver is usually rapid and energetic.

Westinghouse Company Secures Manhattan Elevated Contract.

After about two years spent in studying the questions involved in changing the motive power for the Manhattan Railway company's lines in New York from steam to electricity, the company has awarded the contract for the generators at the power house and the machinery at the sub-stations to the Westinghouse Electric and Manufacturing company. The apparatus under contract consists of eight three-phase alternating-current generators, each of 5,000 kilowatts' capacity, together with 76 step-up and step-down static transformers and 26 rotary converters for the sub-stations, in all about 157,000 kilowatts of machinery. The direct current will be fed to the third rail of the elevated system. The 5,000-kilowatt generators will be the largest ever designed or constructed. The rotating element, which includes in itself the field of the generator and the necessary flywheel for the engine, and which will be mounted directly on the shaft of the engine, has a diameter of 32 feet. Some idea of the size of these generators may be gained from their dimensions and from the fact that the weight of each machine and engine complete will be nearly 1,000 tons.

The current generated by these large machines will be conveyed to various sub-stations conveniently placed about the city. In these sub-stations will be installed 26 rotary converters in units of 2,000 horse power each. These rotary converters are designed to produce direct current at 500 volts for use on the elevated structure. The first of the large dynamos is due for delivery in 10 months, so it is reasonable to expect that part of the Manhattan system will be electrically operated within a year.

The directors of the Manhattan Railway company nine months ago took the first decisive step in the direction of changing the equipment of the elevated lines when they intrusted to President George J. Gould the responsibility of deciding whether electricity or compressed air should be adopted as the motive power, and also voted to issue $18,000,000 additional stock, from the proceeds of which the expense of the contemplated improvements should be met. President Gould promptly decided in favor of electricity, and a few days later the company announced the appointment of William E. Baker, as chief electrical engineer of the Manhattan system. Mr. Baker gained his experience with elevated electric railways in Chicago. He was manager of the pioneer Intramural railway at the World's Fair and afterward planned the electrical equipment of the Metropolitan system on the West Side. On June 27th President Gould announced that the company had secured a tract of land at Seventy-fourth and Seventy-fifth streets and the East River as a site on which a large power house would be erected, and also that a contract for 9,000 tons of "third rail" had been awarded to the Lackawanna Steel company. A few weeks later came the announcement that the Babcock & Wilcox company had secured the contract for the boilers, and that the E. P. Allis company would furnish the eight engines of 6,600 nominal horse power each. The contract for the dynamos, just awarded to the Westinghouse company, it is understood, involves an expenditure of about $1,500,000. There remains the contract for furnishing the motors, which is to be awarded as soon as it shall be decided whether the multiple-unit or electrical-locomotive system of propulsion is the more desirable for the operation of the Manhattan Railway company's cars.

English Scheme for Package Transportation by Electricity.

A foreign correspondent of the Western Electrician writes: "A new system for the electrical operation of pneumatic tubes has been proposed by Mr. Thelwall of London, and will very probably be put in operation shortly. About 40 years ago an English company established a system of pneumatic tubes for the transportation of letters, packages, etc., from the central London office to the Easton station. This was made of sections of cast-iron of 0.12 inch thickness and four feet in diameter. For different reasons, the installation was not a success, and had to be given up after a number of trials. It is now proposed to re-open the system by the use of electric traction in place of the pneumatic method; this is to be carried out on the lines proposed by Mr. Thelwall.

"In this arrangement a number of small cars will be used, operated by electric motors. As the cars are, however, too small to admit of placing a motorman, a system has been devised by which they will be operated and directed from the station at the end of the line. The position, speed and direction of each car is noted by a special indicator, and these are entirely under the control of the operator. The system is ingenious, and there is no doubt that it will be carried out in the near future. The speed proposed for the cars is from 30 to 40 miles an hour."

This system seems to be practically identical with that of Mr. N. Sampson of Chicago, which was briefly described in the Western Electrician of March 18, 1899, under the heading "Electric Mail Transmission in Conduits." Mr. Sampson has been working on the idea for several years, particularly with the idea of transmitting sacks of mail matter. The postoffice authorities have paid some attention to the plan, but the system has never been given a practical test.

The Nernst Light.

Frank H. Mason, the energetic consul-general of the United States at Berlin, has made a brief report on the Nernst electric light. His statement contains little that is new, but is worth repeating as showing the advantages and disadvantages of Professor Nernst's invention as they present themselves to a practical man of affairs. Mr. Mason states that the lamp consists of a rod of incandescing material, three or four inches long, made from the so-called rare earths, held by metallic attachments at each end and enclosed in an open glass globe. He then says:

"This combination of oxides is in the highest degree refractory; that is, capable of withstanding very high temperature, but it is at the same time a non-conductor of electricity when cold and only becomes an electrode when heated to a certain temperature. Its obvious advantage is, therefore, that it will bear pressures which would quickly destroy an ordinary carbon filament; and, as the luminosity of the lamp is measured by the temperature which it can withstand, it follows that the Nernst lamp should produce a given quantity of light cheaper than by the ordinary lamp with carbon filament. It is claimed for it that its consumption, including the resistance, is but 1.5 watts per candle for large lamps and 1.6 watts for small lights or low pressures. Another—perhaps the chief—advantage of the new lamp is that whereas the light of an ordinary carbon incandescent lamp is too yellow, an arc light too blue, and a Welsbach gas light of a greenish hue, the Nernst lamp gives a light having almost precisely the same spectrum as sunlight, and it is asserted that this is the only artificial light by which delicate colors can be matched with practicable certainty.

"On the other hand, Professor Nernst's invention would seem to be subject, at its present stage of development, to two grave defects, both of which may be more or less successfully overcome, but which now seriously restrict its commercial value. The first of these is the fact that it does not light instantaneously by simply turning on the current; the rod of refractory oxides must first be heated. For this purpose two devices are used—a small spirit lamp, which must be lighted with a match and turned out when the electrolyte has become hot and begun to glow, and, secondly, a heater, in the form of a coil surrounding, but not touching, the incandescent glower. This heater is supplied by the current from the moment when it is turned on, and is so arranged that when the rod has been heated and has begun to glow, the heater is automatically cut out of the circuit and relapses into disuse until needed again to light the lamp. All this apparatus, although beautiful as a mechanical device, is so expensive as to seriously limit the value of the lamp for practical purposes. Thirdly, the life of the incandescent glower, if operated at so high a temperature as to reach the best efficiency—say, two-thirds of a candle per watt—does not exceed 300 hours, while the carbon filament is good for from 600 to 1,000 hours.

"Until the first two of these defects can be reasonably overcome by further improvements, the use of the Nernst lamp will probably be confined mainly to large, powerful lights in stores, restaurants, churches, railway stations and public buildings, where the few seconds of time which is required to artificially heat the oxide rod to conductivity and the initial cost of the lamp itself are of small importance compared with the saving of two watts per candle and the advantages of an electric light as genial and normal as sunlight. For photography, it will probably supersede all other forms of artificial light and make the photographer practicaliy independent of weather.

"Any general adoption of the Nernst light would require that, in the end, systems of distribution which are now made for the carbon lamp should be laid out to suit it, and this would lead to important economies in cables, which now form so large a part of the cost of distribution systems. The new lamp can not only compete with the carbon filament at all ordinary pressures to which the latter is adapted, but in the higher pressures it will have the field practically to itself. Though not at present a perfected invention, it is entitled to the interest which belongs to a discovery that involves a radical departure from existing methods and points out a new direction in which future progress is likely to be made."

Two Anglo-American Tramway Companies.

In Dover, Del., a few days ago, there were filed two separate charters, from the nature of which it is thought that combinations of English and American capital are ready to undertake the construction of tramways in Great Britain. One concern is known as the London Electric Tramway Construction and Maintenance company, with a capital stock of $2,500,000. The other corporation is the British Electric Street Tramway company, with a capital stock of $5,000,000, and with power to construct and operate trolley lines in Great Britain and her colonies. By its charter the company expects to begin operating at Dover. It is asserted that Albert L. and Tom Johnson, the well-known American street-railway men, are interested in these companies, which expect to obtain valuable concessions from the English government.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Beloit (Wis.) Telephone company now has toll connection with Janesville.

Onida, S. D., will be connected by telephone with Blunt, S. D.

Telephone connection is about completed between Armour and Wheeler, S. D.

The Dakota Central Telephone company is building a line to Veblen and Sisseton.

The mayor of Duluth, Minn., observed that the Duluth (Bell) Telephone company is quietly making many improvements, putting in copper circuits, etc., and asked the council to notify the company that on and after the completion of the system being installed by the Zenith City Telephone company, that the former will be expected to quit. The Duluth Telephone company's franchise has expired, and it is to prevent its raising the statement that it was allowed to make improvements at great expense without warning that this action is taken.

The city engineer of St. Paul has prepared a map showing the location of every pole in the district where all telephone and other wires were ordered in 1893 to be underground by 1897. There are 500 poles. No new poles will be allowed in the forbidden district. A crew of workmen was arrested lately for attempting to plant a pole in the district.

The Mississippi Valley Telephone company is hurrying up contractors to get out its supplies, in order to complete the exchanges in Minneapolis and St. Paul at once. Toll connections have been completed with a number of towns in Southern Minnesota.

Business men of St. Charles, Minn., talk of forming an independent telephone company because the local system has made a contract with the Bell interests.

The city engineer of Minneapolis removed 10 telephone poles on Twenty-fourth street, between Emerson and Bryant, the property of the Northwestern Telephone Exchange company, on orders from the council. The telephone company may swear out a warrant for his arrest.

The Fairmont (Minn.) Telephone company will make a number of changes and improvements to its system.

The Little Wolf River Telephone company has asked a franchise at Kaukauna, Wis., to extend a toll line into that place.

George G. Candee has been given a franchise for a telephone exchange at Dickinson, N. D.

It is rumored the Wisconsin Telephone company will rebuild the line from Sturgeon Bay, Wis., to the north end of the peninsula.

The telephone exchange at Hurley, Wis., now has about 300 connections.

Several weeks ago Commissioner Vollmar of the Board of Public Works at La Crosse, Wis., called the manager of the La Crosse Telephone company to his office and collected a fine of $5 from him for digging a hole in a street without permission. Vollmar did not have the manager arrested, but collected the fine. Now the mayor wants an investigation. Vollmar claims to have done so on the advice of the city attorney, and the latter says he was only "joshing."

The Salem (S. D.) Telephone company has been incorporated, with $1,500 capital stock.

Telephone connection has been made with Clearwater, Minn., from Clear Lake. The Minnesota Central company proposes a line to Clearwater.

There is talk of constructing a telephone line between Janesville, Minn., and Elysian, Minn.

The Supreme Court of Minnesota holds that a telephone company is not responsible for an accident occurring to a child in grasping a rope being drawn through a pulley, the rope and work being in the hands of an independent contractor. It was the case of George Varbeck against H. M. Kellogg and the Mankato Citizens' Telephone company.

A local telephone system will soon be installed in Sleepy Eye, Minn.

The Iowa Telephone company has just extended a metallic-circuit system into Northeastern Iowa, to connect with Dubuque.

The Iowa Telephone company has put new and lower rates into effect at Davenport, Ia.

The Lisbon (Ia.) Telephone company has been incorporated, with $10,000 capital stock.

The telephone exchange at Northwood, Ia., now has all-night service.

The Ellwood Telephone company has materials on hand and work well along for installing an exchange at Sac City, Ia.

The Standard Telephone company has been enjoined from setting poles in certain alleys in Dubuque, Ia., occupied by the poles and wires of the Home Electric company. The latter offers the use of its poles for the telephone wires, the latter to be strung below its own. But the telephone company wants its wires above the electric-light wires, which the electric company says would endanger the lives of workmen in going through the electric wires.

Rival telephone companies are working to get into Chesaw, Wash., and the Myers Creek district.

The Inland Telephone company expects to occupy its new building in Spokane, Wash., by December 20th. The company has completed a toll line to Coulee City. The new building will be equipped with a flashlight switchboard.

The new telephone exchange for Delavan, Wis., is about ready for operations.

The Custer County Telephone company of Miles City, Mont., expects to have 40 miles of wire in use by December 15th.

W. T. Adams and Ernest Palmer, doing business as the Elgin Telephone company of Elgin, Minn., have dissolved, Dr. W. T. Adams succeeding.

Fruits of Competition in Niagara Falls.

"In Niagara Falls," writes a correspondent of the Western Electrician, "every annoyance possible is being developed by what is supposed to be the opposition to the new Home Telephone company. When the Home company was setting poles in front of the property of Mrs. Woolworth, the first opposition manifested itself, and there was an injunction issued. This case was apparently settled, but afterward a man in the employment of the property owner cut down one of the poles, no doubt to bring about a test of the rights of the company under its franchise. In other parts of the city lawyers have been at work getting property owners to bring suits against the company in order to interfere with its progress, and make its franchise and construction cost as much as possible. However, public sentiment is strongly in favor of the Home company, and the people intend to see that there is honest and just competition in the telephone business in this city, having been long enough in the grasp of a monopoly. The Bell company has commenced work on its new station, and it is equipping a long-distance substation in the Arcade building; all this in order to give the people the first-class service they have long recognized the city should have, but which the Bell company did not start to install until forced by the Home company. The public already realizes that the Home company, in what it has forced the Bell people to do, has been of material public service, and the honest citizens applaud the new company and its energy. John C. Brewster, formerly superintendent of the Niagara Falls and Suspension Bridge street railway, has been appointed local manager of the Bell company. The Barrett system, installed by the Bell company in Niagara Falls at a slight reduction in the rates, is working nicely."

Bell Output.

The American Bell Telephone company is deriving much satisfaction from the statement of the output of instruments for the month ended November 20th. The gross output for the period named is the largest number ever placed in a single month in the history of the company, and foots up 69,117. Moreover, the month becomes noteworthy from the fact that the total number of instruments outstanding has crossed the 1,500,000 mark. The month of March of the current year holds the record still for net output, being credited with 53,503 instruments, but the net output last month was 49,125, which is an excellent total. The net output for the 11 months from December 21, 1898, to November 20th is 425,452.

She—What did papa say?

He—I asked his consent to our marriage by telephone, and he replied, "I don't know who you are, but it's all right."—Boston Traveler.

Telephony in Sweden.

Every telephone man knows that Sweden (with an area of 17,216 square miles and a population of 5,009,632) is a country where a widespread use is made of the telephone. Rates are low and the service is fairly good. In Stockholm, and, indeed, throughout Sweden generally, more telephones are in use, in proportion to population, than in any other city or country in the world. Outside of Stockholm the government owns and operates most of the lines. In the metropolis the Stockholm

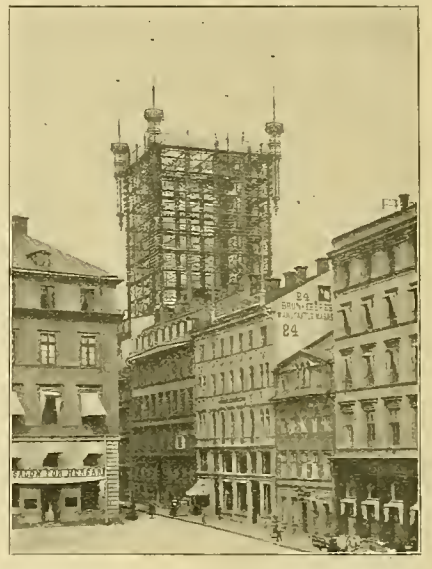


FIG. 1. TELEPHONY IN SWEDEN.—WIRE TOWER OVER MAIN EXCHANGE IN STOCKHOLM.

Allmänna (General) Telephone company—a private corporation—does a large business.

Government statistics, excluding entirely the large Stockholm company and other private concerns, show that in 1898 there were in the country 880 exchanges, with 33,638 subscribers and 39,685 instruments. The telephone lines were 6,126 miles long and were made up of 53,935 miles of wire. The number of conversations was 96,118,952; gross receipts, $830,931; operating expenses, $398,240; amount covered into the treasury, paid for interest, etc., $210,079. The previous statement as to low rates is borne out by the official statement that the average amount paid for the service was $14.32 for each subscriber in 1898. The cost to subscribers has been steadily decreasing in recent years; in 1894 it was $17.30. The sum of $726,383 was spent on new construction by the government in 1898, and the whole system now represents an investment of $4,241,409. To a considerable extent the telephone has superseded the telegraph, and it is largely used for train dispatching also.

The Stockholm General Telephone company operates in the capital and in the surrounding district to a distance of 44 miles. It was organized in 1883 and has steadily grown, the number of sub-

FIG. 2. TELEPHONY IN SWEDEN.—MAIN OPERATING ROOM IN STOCKHOLM.

scribers on August 1, 1899, being 22,881, of whom about 3,950 were outside of the city proper. Thus Stockholm, with 250,000 population, has 19,000 telephone subscribers, or one to every 13 of the population. Chicago, by comparison, has a telephone subscriber for every 105 of the population. But then the rates are different in the two cities.

The main office and main exchange of the Stockholm company are located in a plain five-story building, principally distinguished by the elaborate orna-

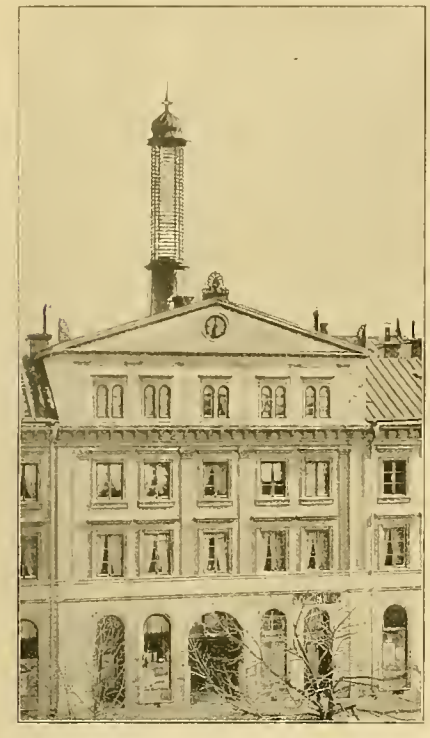


FIG. 3. TELEPHONY IN SWEDEN.—EXCHANGE BUILDING AND WIRE TOWER AT UPSALA.

mental iron tower on the roof, as shown plainly in Fig. 1. This tower is used for wire distribution. The interior of the operating room at the main exchange is shown in Fig. 2. The impressive size of the switchboards and the elaborate decorations will be noticed. Ericsson apparatus is used. The Stockholm company's exchange in the famous university town of Upsala, showing a different form of wire tower, is pictured in Fig. 3.

Figs. 4 and 5 show varying forms of overhead line construction for telephone wires, according to Swedish practice. The former depicts an interesting method of cross-arm construction and also a bracket supporting heavy cables on a roof. Fig. 5 shows distributing rings on a pole placed on a house-top.

Rates are low in Stockholm as well as in the

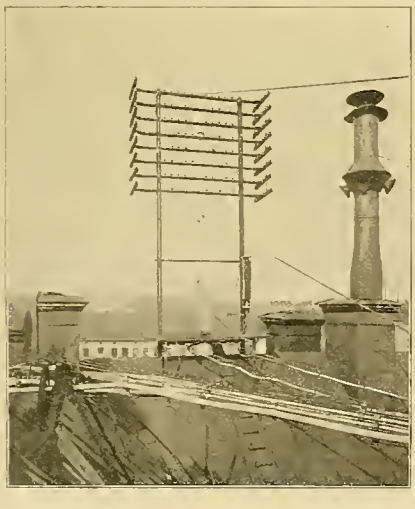


FIG. 4. TELEPHONY IN SWEDEN.—LINE CONSTRUCTION OVER HOUSE TOPS.

country. For $27 a year the subscriber has unlimited service over the whole district covered by the Stockholm company. For service restricted to his own city or district the subscriber pays but $13.50 a year. Residence telephones cost $9.72 a year, and for this sum the subscriber has unlimited access to about 5,000 subscribers in the same class, whose names are indicated by stars in the catalogue. In addition he has 400 calls allowed him to other subscribers. After exhausting this number of calls, a charge is made at the rate of 2.7 cents a call.

American Bell Company to Be Merged in Long-distance Company.

[From the Boston correspondent of the Western Electrician.]

Boston, December 1.—Both the expected and the unexpected happened to-day at a meeting in this city of the directors of the American Bell Telephone company. It has long been understood that this corporation would be consolidated with the American Telephone and Telegraph company of New York, otherwise known as the Long-distance company. It was supposed, however, from rumors current, which appeared to have their origin in circles close to the management, that three shares of the absorbing company would be given to stockholders in exchange for one share of American Bell stock. The expected absorption is an assured fact, but the basis of transfer is to be two shares of Long-distance for one share of American Bell, if the recommendations of the directors are carried out. The meeting took place at the Bell headquarters and was largely attended. President Hudson was in the chair, and the matter was freely discussed. After the meeting the following statement was given out, with the assent of the officials, the Bell people:

"The substance of the action taken at the meeting of the directors is that the assets of the American Bell Telephone company are to be taken over by the Long-distance company (American Telephone and Telegraph company).

"It is to be recommended that two shares of Long-distance company stock be exchanged for one share of American Bell Telephone company stock. The balance of $19,000,000 or $20,000,000 of Long-distance company stock will be held for the benefit of the Long-distance company."

It is still left to be inferred that this is the first step toward the removal to New York, which has been predicted so freely during the past year. The Long-distance company is a New York corporation, however, while the Bell Telephone company is a Massachusetts corporation, and it has been intimated times without number that the laws of this state were never quite liberal enough to please the Bell people. Presumptions have strongly pointed, therefore, to such a removal, and it would surprise nobody who has observed the drift of matters recently to witness its consummation as soon as the proposed change goes into effect.

It has been asked, apropos of this view of the situation, why the telephone management has acquired additional real estate adjoining the company's present holdings in Boston, and has gone to the trouble of making plans for additions to the structure now known as the Telephone building, if it does not intend to continue to occupy these premises. For answer, on the other hand, it is pointed out that the New England Telegraph and Telephone company, a Bell dependency, has been absorbing other companies in New England lately, and will need all the elbow-room it can add to its present facilities in this city.

The annual meeting of the American Bell Telephone company is held in March, but a special meeting may be called at any time. It is not disclosed as yet whether the matter will be submitted to the stockholders at an earlier date or held in abeyance until the next annual session. No hint can be obtained as to the dividend status under the prospective regime. Long-distance stock is practically owned by the Bell Telephone company now, and has paid five per cent. annually. It has been one of the "assets" of the latter corporation, but hereafter it is destined to be the central figure of the entire Bell system.

The growth of that system from May, 1877, when Gardiner G. Hubbard, father-in-law of Professor Bell, sent out the prospectus which resulted in the formation of the Bell Telephone association, down to the present time, when a capital of $75,000,000 is authorized by the certificate filed with the secretary of state at Albany, N. Y., on the 28th of March, 1899, announcing an increase of the capital stock of the American Telephone and Telegraph company from $25,000,000 to that figure, is one of the marvels of the age. The association above referred to granted rights to the New England Telephone company, organized in this state and incorporated February 18, 1878; and the Bell Telephone company, authorized to do business outside of New England, followed July 30, 1878. The former company's certificate rated its rights at $150,000 and cash capital at $50,000. The latter company rated its rights at $400,000 and cash at $50,000. Their union as the National Bell Telephone company, February 17, 1879, with $850,000 capital, took place as the next step in the progress of the industry, this capital being made up as follows: Rights, $650,000; telephones and apparatus, $88,000; interest in New York, Chicago, Boston and Lowell district systems (4-10 each), $102,000; cash, $10,000. The following June a few shares were sold at auction for $110.50 each, the par being $100, then sales were made a little later at $135, next month at $227.50, and on September 10th at $370. Compromise negotiations with the Western Union company had a great deal to do with this result. The stock was next listed on the Boston Stock Exchange, and the first sale was made at $500 on October 9, 1879. By the 30th of the month it had risen to $750, and on November 11th, the day after the compromise was actually effected, it went to $1,000.

On March 19, 1880, the governor of Massachusetts approved a bill incorporating the American Bell Telephone company, not with the capital of $20,000,000 asked for, but with $10,000,000 capital instead. The conveyance to the new company from the old one shows the 'rights" with a new value, namely, $6,500,000, quite a stride from the old figure of $650,000. At the time of this incorporation there were only 60,873 instruments in use, actually less than the output gross for the past month alone. The capital has been increased from time to time since then, but the directors ran against a pretty large snag in 1894, when a bill which had run the gauntlet of both branches of the Legislature of Massachusetts, increasing the capital to $50,000,000, was vetoed by the late Governor Greenhalge. Since that time a sort of mutual distrust has sprung up between the voters of the old Bay State and the Bell folks, and removal to New York is regarded as an inevitable sequence. The last annual report of the condition of the corporation, filed with the secretary of state in accordance with Massachusetts law, makes the following showing in round numbers:

ASSETS.

Real estate	$ 1,243,745
Machinery	11,415
Cash and debts receivable	5,103,404
Manufactures and material	2,497,302
Miscellaneous	59,029,041
Total	$67,884,907

LIABILITIES.

Capital stock	$25,886,300
Debts	9,065,274
Reserves	32,933,333
Total	$67,884,907

Outlook in Boston.

Rapid progress is reported on the construction work of the newly organized Massachusetts Telephone and Telegraph company. President Z. S. Holbrook states that conduits have been laid in five of the principal streets downtown in Boston, and 150

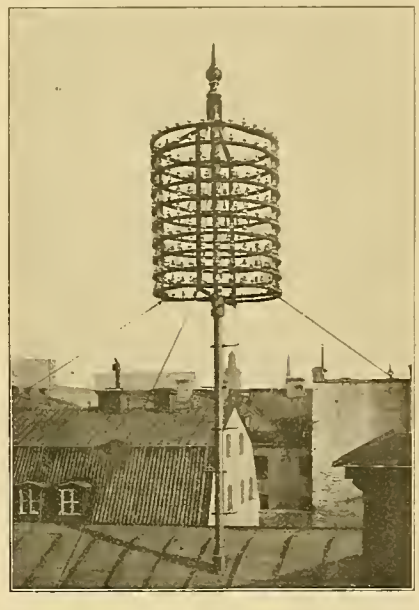


FIG 5. TELEPHONY IN SWEDEN —DISTRIBUTING RINGS.

miles of wire, together with the poles therefor, have been acquired for connection with other cities in the state. "Within six weeks," says Mr. Holbrook, "we expect to be talking with Springfield, Worcester, Providence, Taunton and other points, and before a year has passed we shall give our Boston subscribers, already numbering between 4,000 and 5,000, a complete telephone exchange. Our relations with the new Telephone, Telegraph and Cable company make this a certainty."

Central Telephone Company.

Charles H. Seitz, for several years manager of the Michigan Telephone company in Detroit, has been elected a director and general manager of the Central Telephone company, with headquarters at Kalamazoo. The Central company is operating over 2,000 miles of toll lines and several exchanges in the southern part of Michigan, and has increased its capital stock to $500,000. Officers of the association are: President, Fred S. Lee, Dowagiac; vice-president, D. D. Streeter, Kalamazoo; secretary, H. H. Everard, Kalamazoo; treasurer, E. S. Roos, Kalamazoo.

Carty Patent Suit in Pennsylvania.

A dispatch from Pittsburg last week stated that the case of the Western Electric company against the Anthracite Telephone company of Hazleton, Pa., for alleged infringement of the Carty bridging-bell patent, was on trial in the United States Circuit Court in Pittsburg. The case was undecided at the last account.

Adrian, Mich., enjoys a three-cent street-car fare. Single fares are five cents, but 100 tickets are sold for $3.

The Telephone Situation.

The latest news in the kaleidoscopic telephone situation is that the People's and Knickerbocker (Independent) companies of New York have both been absorbed by the Telephone, Telegraph and Cable company of America. The Chicago Tribune correspondent, writing on December 4th, says that the consolidation was effected on that day and adds: "The consolidated companies will be operated in New York under the name of the People's Telephone Corporation, and outside of New York as the American Telephone, Telegraph and Cable company. They will be open for telephone business in New York on New Year's Day, and have already 7,000 contracts with New York city subscribers. In New York city they will charge $100 a year for unlimited service and $30 for limited service. The New York Telephone company, known as the Bell company, charges $240 for unlimited and $90 for limited service. The new concern proposes to transmit long-distance messages for 50 per cent. of the rate now charged by the Bell concern. The new telephone company has a surprise in store for its high-priced rival. When last Sunday was five minutes old it began laying its wires through the conduits of the Metropolitan Traction company. The laying of the wires is now about completed. The permit for laying the wires was secured late on Saturday, and it is believed Richard Croker's influence secured it."

It is asserted by some that Messrs. Widener, Elkins and Dolan withdrew from the Telephone, Telegraph and Cable company of America (promoted by Martin Maloney) owing to the pressure of Bell interests. The New York Sun says: "There is a rumor that the same pressure exerted on the Widener and Elkins interests to retire from the management of Maloney's company will ultimately prevail on Charles E. Adams and Oakes Ames, two other directors, who as officers and heavy stockholders of the Boston and New York Telephone company, organized as a rival of the Bell company in New England, were instrumental in consolidating their interests with the Maloney company. Friends of Maloney point to the financial resources of William H. Crocker of San Francisco and John Jacob Astor, two other directors, as an offset to the retirement of Widener, Elkins and Dolan. But it is believed here that J. J. Astor has little money invested with the Maloney company."

Another complication is introduced by the Independent Telephone company of New York, with principal office at 1123 Broadway, New York city, which was incorporated on November 28th at Albany. It proposes to operate its lines in New York city and to connect with Montauk Point and other places eastwardly on Long Island, and northerly to Rouse's Point and other places, and westerly to South Ripley and other points. The capital stock is $100,000, and it may be increased to $20,000,000. The directors are Frederick Meyers, James J. Russell, C. W. Phillips and Henry Teneneck Wendell of New York city, and Franklin Noble, Charles Tremaine and James C. Merwin of Brooklyn. The Maloney people hint that this new company is organized in the interest of the Bell company.

A recent Baltimore dispatch states that Alexander Brown & Sons, bankers of that city, have about completed negotiations for a consolidation of the United Telephone and Telegraph company, which was recently incorporated by Baltimore capitalists under the laws of New Jersey, and the Federal Telephone and Telegraph company, which also has a New Jersey charter. The United Telephone and Telegraph company will, it is said, absorb the Maryland Telephone and Telegraph company, the Pittsburg and Allegheny Telephone and Telegraph company, and plants in Wilmington, Del., Alexandria, Va., and Jersey City, and will establish service in Philadelphia, Washington and other cities. It is also proposed to establish long-distance communication between St. Louis, Pittsburg, Washington, Baltimore and other cities in the East, South and West.

GENERAL TELEPHONE NEWS.

The grounded circuit between New Ulm and Springfield, Minn., has been changed to a copper-metallic, and patrons find it a great improvement.

B. F. Wasson, superintendent of the Farm and City Telephone company of Farmer City, Ill., states that he has purchased R. C. Smith's interest in the entire system of 400 miles, paying therefor $6,000. Mr. Wasson took possession on December 1st.

The New England Telephone company began the month of November with a reduction of prices for residential subscribers in Lynn, Salem and adjacent territory. Heretofore the charge has been $48 annually for unlimited service and $25 for limited 500-call service. Now the rate is $25 for unlimited service.

Charles A. Gates of Saginaw, for many years local manager of the Bell Telephone company and recently appointed district superintendent of the eastern division of Michigan, has been appointed superintendent of the long-distance service for the Southwestern Telegraph and Telephone company, operated by the Erie company. His headquarters will be Dallas, Tex. He will have charge of 23,000 miles of lines in Texas and Arkansas. He will take his new position on January 1st. He will be succeeded at Saginaw by George E. Dutton of Port Huron.

Street-railway Affairs in Chicago.

Negotiations looking toward the absorption of the Consolidated Traction company by the Chicago Union Traction company are undoubtedly under way. Mr. Yerkes, who controls the majority of the Consolidated stock, will neither affirm nor deny the reported transfer. However, he asserts that the consolidation of all the surface and elevated-railway systems of Chicago is only a question of time, and that in a short period he will be no longer interested, practically, in the surface lines of Chicago. Mr. Yerkes predicts that the time is coming when it will be possible to ride from one end of the city to the other for a five-cent fare. There is no present movement toward the amalgamation of the elevated-railway companies, he says, but that will come after the North Side elevated road is in operation, some time after June 1st of next year.

The Chicago Consolidated Traction company was formed early in the present year by the consolidation of seven distinct electric-railway systems in the suburban districts on the North and West Sides. It is capitalized at $15,000,000 and operates 330 cars over 200 miles of track.

It is said that if the Consolidated lines are secured, the Chicago Union Traction company may endeavor to secure control of the Suburban Railroad company, which operates about 60 miles of track in the western suburbs, connecting the Metropolitan and Lake Street elevated roads with La Grange and other points.

On the South Side the Chicago Union Traction people are not represented at present, as far as is known. The position of the Chicago City Railway company is particularly strong, and it is said that its owners want $400 a share for their stock, and are not particularly anxious to sell at that figure. On the extreme south there are three suburban companies—the Electric Traction, Calumet and South Chicago—and it is reported that the owners of the Union Traction company have made some overtures looking to the acquisition of these suburban lines in order to be in better position to negotiate with the Chicago City company.

Union Traction stock has gone up in price on the consolidation rumors and a favorable report of November business.

At the annual meeting of the Union Elevated Railroad company on December 4th the balance sheet showed a surplus for the year ended November 30th of $83,435, after the payment of $200,000 as the first dividend of 4 per cent. on the stock. John M. Roach was re-elected a director for one year; H. M. Brinckerhoff, assistant general manager of the Metropolitan West Side company, was elected in place of W. E. Baker, resigned, and L. S. Owsley in place of J. Charles Moore, resigned. During the fiscal year the company received as rental from the elevated roads using the loop $382,317. In speaking to the shareholders, Mr. Yerkes said, among other things: "In the matter of dividend rate, I will say that has not been fixed, and probably will not be for some time. Meanwhile, whenever a fair surplus is accumulated, it will be paid out to the shareholders. They will be given the benefit rather than have the funds lie in bank." Speaking of the position of the Union Elevated, Mr. Yerkes pointed out the fact that the elevated roads were gaining traffic now at the rate of about 20 per cent. per annum. Within four or five years, such a rate continuing, their income would be doubled, and, in consequence, the Union Elevated income would be correspondingly increased.

CORRESPONDENCE.

New York Notes.

New York, December 2.—The Third Avenue Railroad company has certainly had its full share of troubles during the week in operating its new underground lines. Several delays have been occasioned on the Third avenue route between One-hundred-and-twenty-ninth street and the postoffice since the part of the route from Sixty-fifth street north was opened more than a month ago, and especially within the last few days on the section from Sixth street to the postoffice. These delays were the result of a combination of causes, but were principally due to the hasty work in trying to change the motive power without stopping the operation of the road. The greatest problem the company has had to meet was that of providing electric power without waiting for the completion of its large power house. Dynamos were mounted in the Manhattanville power house of the One-hundred-and-twenty-fifth street and Tenth avenue line to furnish power as far down as Sixty-fifth street, but to supply the route south of that the engines of the Sixtey-fifth street power house were used. The dynamos for this purpose were got ready before the change was made from Sixty-fifth south, and these were connected with the engines there in the 24 hours that the road was closed down from Sixty-fifth street to Sixth street, and cables were run through the subways and connected with the feeder rails in the conduit, but before more power could be provided a lot of heavy machinery had to be moved, and this job is only approaching completion. Within a day or two another dynamo is to be started, and thereafter, it is believed, the cars will not only run with certainty and smoothness, but the full number available will be in operation.

The cars now being used on the Third Avenue road are in some ways the best-constructed street-railway cars made. They were constructed according to plans made by Superintendent Robertson of the Third avenue company. Each car is 41 feet long over all, the body of the car being 32 feet long. Twelve cross seats are provided on each side, making the seating capacity of the car 48. The platforms are unusually large and the doors are of extra width. The windows are big ones and can be dropped down and boxed up, thus converting the car into an open one. Each car is equipped with four 30 horse power motors and a system of air brakes. The weight of the new cars is 40,000 pounds.

The Brooklyn Rapid Transit company is to have a rival in the shape of a system of automobiles which are soon to travel the principal streets of the borough under the direction of the General Carriage company, which was organized and incorporated in this state recently. James C. Church, formerly counsel for the Nassau Electric railroad, has interested several wealthy men in the scheme. Stock to the extent of $5,000,000 will, it is said, be issued. As the first step to the carrying out of the plan the company has ordered 100 "autos" for its Brooklyn traffic.

Word comes from Hartford, Conn., under date of November 28th, that the Columbia and Electric Vehicle company will buy the plant of the Hartford Cycle company, one of the largest in that city.

It is reported that the employes of the Brooklyn Rapid Transit company who run the cars on the Brooklyn bridge are on the verge of striking. Before the railroad company took charge of the bridge-railroad system the men were city employes and were paid $2.78 for an eight-hour day. They were under civil-service rules and were furnished uniforms and badges. Now it is claimed that the men have to pay for their uniforms and make a deposit for their badges, and also that their wages have been reduced.

Carl H. Schultz has just put into service what is said to be the heaviest horseless wagon ever built. Inclusive of batteries the wagon weighs 5,600 pounds, which, added to the weight of the usual load, brings the total weight up to 7,040 pounds.

M. L. G.

Northwestern Notations.

Minneapolis, December 2.—The Board of Fire Commissioners of St. Paul is considering the purchase of electric signals for the nozzlemen to signal the engineer when to shut off the pressure, but thinks the price, $200 per annum, too high.

The court-house and city-hall commission of Minneapolis is unable to arrive at any decision in the matter of electric batteries, generators, etc., for the building. The county commissioners are in possession of the county side of the building, which is completed, and made a proposition that the commission share the expense of renewing the electric appliances. The attorney of the board holds that the commission cannot do this.

The Railway and Light company of Winona, Minn., has made a proposition to replace the gas and gasoline lamps of the city with incandescents of 25 candle power for $20 a light per annum.

Owatonna, Minn., will install an electric fire-alarm system at once.

The electric-light company at Langdon, N. D., will replace the gasoline engine which has been furnishing power by a steam engine. The change is owing to the heavy advance in the price of gasoline, making its operation too expensive.

Calumet, Mich., capitalists are organizing a stock company to establish an electric-lighting plant at the town of Lake View, from which light would be furnished for Calumet, Red Jacket and Laurium.

The Marquette (Mich.) Street Railway company has done the biggest business the past season of its history. It has doubled its rolling stock and will make several extensions for next season.

The Escanaba (Mich.) street railway, which was idle in 1898, was taken by a new company during 1899 and operated all the season. It has extended a line to connect with the Soo line at Flat Rock.

The promoters of the Black River Falls and Neillsville (Wis.) electric railway say the defeat of bonds in the town of Farmington will not hinder the construction of the line. The route will be changed.

The Anaconda Copper Mining company has been granted a franchise for an electric-light plant at Butte, Mont.

The street-railway company of Spokane, Wash., has let the contract for a large car barn which will cost, with equipment, about $40,000.

The Twin City Rapid Transit company has reduced the running time between Stillwater and St. Paul from 90 to 60 minutes. The new power house at Wildwood has been completed and the power started.

The electric-light power station at Aberdeen, S. D., is being removed to the gas works, where the dynamos will be operated by large gas engines.

The electric-light company of Cedar Rapids, Ia., has ordered 200-light transformers, which will greatly improve its service.

The Board of Water Commissioners of St. Paul has ordered the street-railway company to disconnect its wires from water mains. Fears of electrolysis are partly the reason, but there are others. In one instance a water meter was so charged by

electricity that the meterman received a severe shock. In another case it so worked on the meter that it would not register, although the water was being used right along. The board fears that its meters are being hurt and do not register as freely as the water passes through them.

Emil G. Endress and others have been granted a franchise for an electric street-railway system in Sault Ste. Marie, Mich.

The Duluth Street Railway company will extend its lines in Duluth, Minn., to the suburb of Ironton in the spring.

The electric-light station at Pardeeville, Wis., has been burned out.

It has been rumored at Aberdeen, S. D., that the electric-light company would discontinue its incandescent-electric service. The people were disturbed about it and thought it a move to compel them to take gas service, which is under the same company. The latter has recently moved its electric power house to its gas works, where the electric plant is to be operated by gas engines. When the company asked the council for permission to string wires to its new power house the council refused, unless the company would agree to run the incandescent lights.

The street-railway company of Des Moines, Ia., will extend its line from Valley Junction to Winterset and Greenfield. Surveys will be made at once.

The Tacoma Railway and Power company of Tacoma, Wash., intends to use the power of the Snoqualmie Falls Power company, whether the council annuls the franchise of the latter or not. The former has extended wires to the city limits, where the Power company's wires are ready to enter the city. A connection is now a very simple matter. The Snoqualmie Falls Power company is an applicant for a franchise at Everett, Wash., and proposes to erect a sub-station.

The Electric Light company of Ida Grove, Ia., has completed a public-heating system.

The Des Moines (Ia.) Edison Electric Light company is pushing work on improvements to its Chestnut street power station, adding new electric and power machinery and making other changes, at a cost of $100,000.

The Marshfield and Southeastern company is stringing wires from Marshfield, Wis., to Nekoosa for a telegraph line.

The Twin City Rapid Transit company now has all its system in Stillwater, Minn., in operation.

The St. Paul Gas Light company has been granted a franchise to lay conduits for bringing electric power into the city from the new power plant at Apple River Falls, in Wisconsin. The company did not apply in its own name, but in the name of the Edison company, which it controls, as there was a disposition to alter its franchise under the former title.

The Court-house and City-hall Commission in Minneapolis has been unable to agree upon a dynamo at the recent call for bids, and so rejected all bids and will take new bids on closer specifications.

The Keokuk Electric Railway and Power company of Keokuk, Ia., has been incorporated by J. C. Hubinger alone, with a capital stock of $500,000.

The Illinois Electric company secured the contract to furnish two dynamos for the village electric-light plant at Granite Falls, Minn., at $269.15 each.

W. L. Luce of Minneapolis has been an applicant several times for an electric-light plant, but has been turned down. He has a private plant, which he wishes to extend. The latest application offers a percentage of gross earnings of one per cent. over $20,000 and up to $50,000, and two per cent. on gross earnings exceeding $50,000 annually. The council committee is at work on the franchise and will make such changes as it sees fit and submit to the council.

A. H. Winkler has bought the electric-light system at Glenwood, Ia.

The street-railway company of Des Moines, Ia., plans to construct next year an interurban line from Des Moines to Winterset, Ia., 25 miles, thence to Macksburg, Greenfield and Creston, a total of 75 miles. The high price of material is all that prevents work being started at once.

The street-railway company of Butte, Mont., has been granted a franchise to build and operate an ore and freight road from the Stewart mine to the Butte Reduction Works.

A. D. Armstrong is an applicant for a franchise to put in electric lights at Shakopee and at Chaska, Minn. He proposes to build the power station midway between the two towns and furnish light for each.

The Adams Electric company of Marshalltown, Ia., has appointed I. H. Wells of Edgerton, S. D., resident agent.

W. F. Wagner, an electrician of West Superior, Wis., has invented a new arc light which will burn 150 hours with a single trimming, and from a voltage of 50 to 200. The device is being tested in Superior.

Hillsboro, N. D., voted bonds for an electric-light and water system and awarded the contract to W. I. Gray & Co. to install the system.

The Cascade Water Power and Electrical Transmission company of Deadwood, S. D., will develop the water power of Spearfish Creek, which will furnish 15,000 horse power and will generate electric power for the mines and cities.

The San Poil Mining and Water Power company of Republic, Wash., has been delayed in installing an electric-light system, but is about finished with the work.

Platteville, Wis., is negotiating for an electric-light system.

W. B. Clements has sold the electric-light plant at Cavalier, N. D., to Lang & Horn.

The Triumph Electric company of Cincinnati secured the contract to furnish a 900-light dynamo for the New Prague (Minn.) village plant.

An electric power house will be erected adjoining the milling plant in North Branch, Minn., which will furnish the power.

A gigantic scheme is reported from Butte, Mont., for a string of electric power plants along the line of the Oregon Short Line from Salt Lake, Utah, to Pocatello, Idaho, thence west and north to Spokane and the coast, and also from Pocatello to Butte. Power plants are to be constructed at Melrose, American Falls, Idaho Falls, Shoshone, Nampa, Huntington, Reparta and Spokane. A steam plant, the only one on the line, will be necessary at Monida. Carlisle Mason of Butte is the man who announces these glowing plans. The Oregon Short Line and the Oregon Railway and Navigation company are expected to utilize the power to operate their lines. The officials of these latter roads decline to take any stock in the plan.

R.

Niagara Falls.

Niagara Falls, N. Y., December 1.—The lifeless body of Charles Sheffield, the chief electrician of the Union Carbide company in this city, was found lying across one of the big transformers in the new carbide plant here on November 25th. On his head was found a burned spot about the size of a half-dollar, which told that in some way the unfortunate man had come in contact with the current by accident. The skin and hair were burned to the bone. No one was with Sheffield at the time of accident, but the general supposition is that while working about the transformer he in some way lost his balance and came in contact with a switch. Sheffield had been in the employment of the company for about nine months and was thoroughly familiar with the plant. He was a graduate of the McGill University of Toronto, 26 years old and unmarried.

The loop line about the Niagara gorge for trolley-car service is now complete, the International Traction company having just finished the last link by building a short piece of single track on the Riverway, between Falls street and Niagara street in Niagara Falls, which makes it possible for cars running to the foot of Falls street to make connection with the tracks of the Niagara Falls Park and River railway on the upper steel-arch bridge. Permission to make this connection was given by the state of New York, a special bill having been passed authorizing the State Reservation commissioners to allow the track to be laid.

The work of building the new wheel-pit for the Niagara Falls Power company is now well under way, the contract having been commenced by the National Contracting company. Engineer Walter McCulloh has been placed in charge of the work as manager by the National Contracting company. Mr. McCulloh resides at the Falls, and is an engineer of prominence.

D.

PERSONAL.

Richard J. Hutchinson, superintendent of telegraph of the New York Stock Exchange and an old-time telegrapher, died at his home in New York city November 24th. At one time Mr. Hutchinson was president of the Old Time Telegraphers' association and at his death was president of the Magnetic Club of New York.

F. C. Field, the well-known electrical engineer, at one time connected with the Westinghouse Electric and Manufacturing company, and later with the Link-Belt Machinery company, has just recovered from a protracted illness. Mr. Field's many friends will be pleased to learn that he is on the road to rapid recovery.

Edwin F. Baker, formerly general superintendent of the Brush Electric Light company of Baltimore, Md., has accepted a position with the Société Industrielle d'Electricité Procédés Westinghouse at Paris, France, during the exposition of 1900. Mr. Baker will sail from New York on December 14th, and will remain during the exposition. He was also at the Paris Exposition for the Westinghouse Electric and Manufacturing company in 1889.

Voluntine C. Turner, an old and respected resident of Chicago and one of the pioneer street-railway men of the city, died on December 2d at the age of 76. Mr. Turner, with several associates, organized the North Chicago Street Railway company in 1859, and became its secretary and treasurer. Ultimately he was elected president of the company, and he held this position until the sale of the property to Mr. Yerkes and others, when he retired with a fortune.

ELECTRIC LIGHTING.

Odessa, Mo., will erect a $5,000 electric-light plant.

The Culver company of Tuscola, Ill., has been incorporated by J. H. and J. S. Culver, with a capital stock of $10,000, to build and operate electric-light plants.

A charter has been granted at Harrisburg, Pa., to the Spring Hill Electric Light and Power company of Point Marion, Pa.

The Anniston Electric company has been granted a franchise for the erection of an electric-light and power plant in Anniston, Ala.

The American Telephone and Telegraph company has been granted a franchise for the erection of an electric-light plant in Nacogdoches, Tex.

The power house of the Standard Electric company, located at Blue Lakes City, was damaged by fire recently, entailing a loss of $75,000.

The Shamokin (Pa.) Light, Heat and Power company has been incorporated, with $150,000 capital stock, by C. T. Frick and H. C. Mills of York, Pa.

At a city election in Hastings, Neb., November 9th, the proposition to vote bonds in the sum of $20,000 to build and equip an electric-light plant carried by a large majority.

The Quincy Gas and Electric company of Quincy, Ill., issued invitations to its patrons recently to visit the Empire electric-light plant, which has just been completed.

The Clinton Electric company of Clinton, N. Y., has been incorporated, with a capital stock of $50,000. Clinton and 12 other towns in Oneida County will be supplied by the company with light, heat and power.

The Massachusetts Gas and Electric Light Commission has authorized the issue of 4,000 more shares of stock by the Edison Electric Illuminating company of Boston, the shares to be offered to existing stockholders at $175 a share.

The Sing Sing (N. Y.) Lighting company has been incorporated to supply gas and electricity in Sing Sing and other towns and villages of Westchester County. The following-named are directors of the company: John T. Kirk and B. F. Williams of Brooklyn and L. B. Lampman of Coxsackie.

A company which purposes to furnish light to cities in the southern states has been organized in Jersey City, N. J., under the name of the Columbus Electric Light company. The capital stock is $800,000, and among the incorporators are Charles N. King, John J. Mulvaney and Albert McMahon, all of Jersey City.

The Norwich Gas and Electric company of Norwich, Chenango County, N. Y., with a capital stock of $100,000, filed articles of incorporation recently. The directors are Edward L. Smith, Floyd Kiser, Charles P. Welles, N. N. Betts of Tonawanda, Pa.; John Throop of Norwich; Robert E. Drake of Syracuse, and Selwyn N. Blake of Elmira.

The Long Beach and San Pedro (Cal.) Electrical company, which supplies electric-lighting service to Long Beach, Terminal Island and San Pedro, was recently sold to Frederick H. Rindge and associates of Los Angeles. The new directors of the company are: President, H. V. Carter; vice-president, F. H. Rindge; secretary, George O. Cochran; assistant secretary, L. M. King, and L. E. Phillips.

At its recent annual meeting the Boardman River Electric Light and Power company of Traverse City, Mich., elected the following-named officers for the ensuing year: President, William Loudon; vice-president, Howard Irish; secretary, A. V. Friedrich; treasurer, Sam Garland; directors, William Loudon, Howard Irish, A. V. Friedrich, Sam Garland, Charles Wilhelm, A. Bartak, Robert Caldwell, Louis E. Greilick, J. L. Gibbs.

Stockholders of the Boston Electric Light company have been notified that the necessary authority is secured for an increase of the capital stock. The new issue will bring the capitalization nominally up to $3,000,000 from $2,500,000, by the addition of 5,000 shares. The terms of subscription are as follows: Each stockholder is entitled to subscribe for one new share for every five shares of old stock standing in his name, paying therefor $150 a share.

The Shamokin (Pa.) Light, Heat and Power company was recently formed by a coalition of the Edison Electric Illuminating company, the Shamokin Arc Light company, the Shamokin Gas Light company and the Shamokin Electric Light and Power company. The capital of the company is $250,000, and it has the following-named officers: President, W. C. McConnell; vice-president, Henry C. Niles; secretary, George C. Graeber; treasurer, John Mullen; directors, W. C. McConnell, John Mullen, C. C. Leader, H. S. Zimmerman, George C. Graeber, Shamokin; Henry C. Niles, Charles C. Frick and George E. Neff of York.

ELECTRIC RAILWAYS.

The Citizens' Traction company of Oil City, Pa., recently organized, has elected the following-named officers: President, D. J. Geary; treasurer, J. Hasson; secretary, F. W. Bowen.

The entire trolley system of Lancaster (Pa.) city and county, the property of the Pennsylvania Traction company, has been sold to W. B. Kurtz of Philadelphia for $205,000. Mr. Kurtz purchased

the property for the newly organized Conestoga Traction company, composed of Lancaster, Philadelphia, Reading, Columbia and Wilkesbarre capitalists.

The Danville Street Railway and Light company of Danville, Ill., has been organized with a capital stock of $700,000. Among the incorporators are Frank Lindley, Adam R. Samuel and Orville W. Cannon.

The Galesburg and Monmouth Rapid Transit company of Galesburg, Ill., with a capital stock of $200,000, has been incorporated to build and operate an electric railway by Fred A. Seacord, Howard Knowles and Robert Chapell.

At a meeting of the City Council of Chicago on December 4th a franchise was granted the Chicago City Railway company for a mile-and-a-half extension of its Archer avenue line to Hyman avenue and South Forty-eighth avenue. The franchise will expire in 1915, the date of expiration of the franchise for that portion of the line with which this extension will connect.

Hugh W. Hughes of Chicago has begun suit against the Metropolitan West Side Elevated Railroad company, asking $20,000 damages. Mr. Hughes alleges that on the night of June 24th last he was attacked by footpads on the platform of a station, beaten and thrown to the ground and badly injured. It is claimed by counsel that having accepted the fare of the plaintiff the elevated company was bound to protect him from harm both while actually on its train and while on its premises.

Street-car rides have been sold at the rate of two for five cents by the Calumet Electric Street Railway company of Chicago, between Woodlawn and South Chicago, since December 1st. The tickets, which are good for one month, are issued by Gen. John McNulta, the receiver of the road. The cut seems to be a retaliation directed against the South Chicago City Railway company by the Calumet company for refusing it the privilege of using the former's bridge across the Calumet River at Ninety-second street since the destruction of the Ninety-fifth-street bridge, which has been used by the Calumet company.

A decision rendered by Judge John Goodland at Appleton, Wis., recently, was that electric-railway companies are not responsible for accidents which arise from collision with poles which are maintained in the streets under a franchise granted by the cities. The decision was in the case of W. F. Ketchum of Neenah against the Fox River Valley Electric Railway company. In October, 1898, Mr. Ketchum sustained a fracture of both legs and other permanent injuries, by being thrown from his wagon, when his team was frightened, and dashed against a pole of the Fox River Valley line standing in the curb at the approach of the bridge crossing the Fox River at Appleton. Suit was brought against the company for damages.

The so-called Brice syndicate has made a proposition to the city of Columbus, Ohio, to take all the street-railway franchises which the city may have to dispose of. The syndicate will make a three-cent fare, giving the city the privilege of increasing the fare to five cents and taking the two cents if it sees fit. The syndicate offers to give a bond of $200,000 for the faithful performance of the contract. This proposition is the result of the City Council having declared certain franchises held by the Columbus Railway company void. Disagreements arose at the time of the consolidation of the Columbus Street and the Columbus Central railways, and the council revoked and advertised certain franchises, holding that the claim of the present company was defective.

An agreement has been effected that assures the consolidation of the Troy City Railway company and the Albany Railway company. The new corporation is entitled the United Traction company and is a combination of the street-railroad interests of Troy and Albany, N. Y. The capital stock of the new corporation is $4,000,000. The officers of the new company will be: President, R. C. Pruyn; vice-president, Charles Cleminshaw; secretary and treasurer, J. W. McNamara. The directors will be R. C. Pruyn, Anthony N. Brady, J. W. McNamara, A. Bleecker Banks, James H. Manning, John G. Myers, William J. Walker and Simon W. Rosendale of Albany, and Edward Murphy, Jr., William Kemp, Charles Cleminshaw, Francis N. Mann, William Shaw, James O'Neill and Cornelius W. Collins of Troy.

A combination steam and electric railway is to be operated between Peoria and Pekin, Ill. The transferring of freight between the two points will be accomplished by three 60-ton Baldwin locomotives and modern large-capacity freight cars, while the passenger, express and baggage business of the road will be carried on by trolley cars. The passenger equipment of the road embraces 24 cars. Standard passenger trains will be made up of one trolley car, 43 feet in length, with baggage and express compartment and having a seating capacity of 40 passengers, with a 25 horse power motor on each of the four axles, and a straight passenger coach 43 feet long, with a seating capacity of 48 passengers. The road is called the Peoria and Pekin Terminal Railway, and the company operating it has the following-named officers: President, T. J. Miller; vice-president, W. H. Trumbull; secretary and manager, L. E. Myers; treasurer, P. L. Saltonstall; superintendent, M. H. Hubbell; chief engineer, N. D. Monsarratt.

AUTOMOBILES.

The automobile literature in this country includes eight journals. In France, however, two dailies, a bi-weekly, seven weeklies, and two monthly publications are devoted to automobile interests. Germany, Austria and Great Britain also have their publications.

The Paris municipal council has passed an ordinance limiting the speed of automobiles on the Bois de Boulogne to 12 kilometers (7½ miles) an hour. This action has caused considerable dissatisfaction among the automobilists of the city, who contend that a fair limit would be 20 kilometers (12½ miles) an hour, and would be satisfied even with a maximum legal speed of 16 kilometers (10 miles) an hour.

Incorporation papers of the Duryea Motor company were filed in New Jersey November 28th. The capital stock will be $1,000,000, of which $100,000 will be 6 per cent. preferred stock. The company has purchased the patents of the Duryea Manufacturing company of Peoria, Ill. Henry Crowther of New York city is president and Charles E. Duryea vice-president and chief engineer. The company will erect a large factory in the East in addition to the Peoria plant.

PUBLICATIONS.

Circulars have been issued by the Federal Battery company of New York, which tells of the advantages claimed for its batteries and battery salts.

A bulletin devoted to descriptions and prices of standard knife switches has been recently sent to the trade by the Emerson Electric Manufacturing company of St. Louis.

The Western Electric company has recently issued a bulletin describing the different styles of annunciators and push-button boards which the company handles and a circular which treats of pendent push-button switches used to connect chandeliers, fan motors or other devices with the switch by means of a drop cord.

A handsome catalogue on panel boards has been issued by the Bossert Electric Construction company of Utica, N. Y. Standard fuse boards, branch switchboards, covers for panel-board boxes and switchboards are illustrated. Bossert plugged-steel outlet boxes and Erickson conduit insulators are described in a pamphlet issued by the same company.

MISCELLANEOUS.

At the meeting of the Chicago Electrical association on December 15th a paper by E. S. Halsey on "Electric Meters" will be read. The place of meeting is room 1741, Monadnock building.

Attention has been attracted by a guttapercha-producing plant, a native of northern China, which is cultivated in the colonial garden, Paris. Guttapercha has been produced almost exclusively up to the present by trees growing in the Dutch East Indies, and attempts to acclimate these trees in the French colonies have not been very successful. The rubber trees of Java require conditions that render their culture impossible in all but a few of the colonies. The discovery of a guttapercha producer that may be easily acclimated in France is thus a matter of importance. The advantage of ready growth in a moderate climate is claimed for the plant growing in Paris. It is known as the Eucomia illinoides, and the fruit is said to contain 27.34 per cent. of guttapercha of excellent quality.

TRADE NEWS.

The International Electrical Indicator company of Chicago has been incorporated with a capitalization of $15,000, by Frank E. Davidson, John P. Martin and Edward A. De La Saux, to manufacture and deal in electrical apparatus.

The Niagara Electric Equipment company of Niagara Falls, N. Y., has been incorporated with a capital stock of $20,000. Among the directors are Willis L. Adams, Niagara Falls; Thomas D. MacNoe and Ralph A. Kellogg of Buffalo.

The Cornell Machine company of Chicago has recently closed a large contract at Pittsburg for three 50 horse power, two 40 horse power and two 35 horse power gas engines for an electric-lighting plant. The company feels that it is entitled to congratulations on the termination of this competition, as no less than 14 bidders were after the contract, including some of the oldest and best-known gas-engine builders in the United States.

The Columbian Electric Car Lighting and Brake company of New York is lighting and ventilating cars by electricity generated by power obtained from the car axles. This company's device is said to be rapidly supplanting all other systems for the illumination of railway cars. A number of the leading railroad systems in the country are using the Columbian system. Other devices controlled by the company are the Lindstrom lever brake, the Skinner electric brake for trolley cars, the Syracuse storage battery and a gear device and regulator to be used in lighting country houses and small towns by electricity generated from windmill power.

A number of the stockholders of the Williams Electric company of Cleveland having made application for a receiver, alleging that the concern was insolvent, the company made an assignment to August J. Tiedemann. The assets are given at $32,000 and the liabilities at $18,000. Damage to the business by threatened litigation is given as the cause of the assignment. It was alleged in the petition that some of the stockholders were conspiring to ruin the credit of the company.

The "Treatise on Ventilation and Heating," published by the B. F. Sturtevant company of Boston, discusses very exhaustively the determination of heating capacity for a given space. Many variables enter into the determination, among which are the difference in temperature between the indoor and outdoor air, the material of the walls, the relative area of window-surface, the climate, the location and the method of heating. "With so many modifying considerations it is evident that no unalterable rule can be given for heating all classes of buildings, but that satisfactory results can only be obtained by separate calculation for each." A table of coefficients to be employed in determining the relative rates of heat transmission for various substances is also given.

Woven-wire dynamo brushes, as manufactured by the Crown Woven Wire Brush company of Salem, Mass., are made of pure copper or phosphor-bronze in wire-cloth form. The cloth in the center is made of braided wires, woven together with a covering of finer cloth woven after the manner of lace. Crown brushes are made in any size, a special brush being made for low-voltage machines. The Crown company also manufactures several styles of flexible commutator connections and a commutator compound that is guaranteed to save the wear of the commutator and brushes and to reduce greatly the sparking and heat. Interesting pamphlets have been issued by the company dwelling on the merits of its brushes and lubricant, and they will be sent to interested persons.

The Western Electric company's constant-potential, enclosed arc lamp for alternating circuits is said to be the only lamp operated upon the repulsion principle. Practical tests, extending over a period of the last six months, have shown that lamps constructed on this principle are for many reasons well adapted for the special class of service for which they are designed. Great changes in voltage and frequency, irregularities in character and size of the carbons, affect the operation of these lamps but slightly. This fact is something that is appreciated, both by the station manager operating commercial circuits and by his customer. The demand for Western Electric alternating enclosed arc lamps for constant-potential circuits has steadily increased. The catalogue illustrating these lamps, which are known as the Petite alternating arc lamps, has been distributed to various central stations. A copy will be mailed upon request.

BUSINESS.

The Electric Appliance company, Chicago, calls attention to Packard, Mogul and sign lamps for holiday and decorative lighting.

The Federal Battery company of New York reports a steadily increasing demand for Federal battery salts in Canada, a number of shipments having been made last month.

The construction department of the Western Electric company, Chicago, has closed a contract for wiring 1,600 lights and erecting two switchboards for the McCormick Harvester Works of Chicago.

The Central Electric company, Chicago, is having a special run on Duplex lamp guards, Knapp annunciators and bare and insulated wires. A pamphlet on telephone construction material and tools is sent on application.

Mathias Klein & Son, Chicago, manufacturers of linemen's tools, report a gratifying volume of business. The Klein climbers for telephone and telegraph linemen are extensively used throughout the country, and the demand is said to be constantly increasing.

The General Electric company recently secured a contract from G. F. Greenwood, chief engineer and general manager of the Havana Electric Railway company, for three 850-kilowatt direct-connected generators and 110 car equipments, including motors, wires, controllers, etc. The contract is said to be worth $178,000.

The Kansas City and Southern Lumber company, Springfield, Mo., manufactures oak brackets and oak and locust pins, which are said to be in general use in the western and southern states. The company claims to be the largest manufacturer in its line in the West. It makes a specialty of car-load orders and its products have met, it is said, with general favor.

George P. Rex, secretary of the Columbia Incandescent Lamp company, St. Louis, was in Chicago this week. Mr. Rex reports that the demand for Columbia lamps is larger than ever before in the

history of the company, and that it is obliged to run overtime in order to keep up with its orders. Mr. Rex also stated that the company's business shows a marked increase over that of last year.

The D. M. Steward Manufacturing company of Chattanooga, Tenn., announces that it is prepared to manufacture anything in lava. The company makes a specialty of lava tips, washers, bushings and threaded pieces, which, it claims, combine high heat resistance with best insulating quality. The Steward company will be pleased to send estimates on receipt of drawing or model for any particular class of work.

With the holidays so near at hand electrical men, as well as others, are beginning to think of the annual question. A solution is offered by A. C. Becken, 103 State street, Chicago, manufacturer of the Paillard non-magnetic watch. This watch, beside fulfilling the ordinary requirements of a reliable timepiece, is uninfluenced by magnetism and has proved valuable to those employed about electrical machinery.

Users of incandescent lamps will be interested in the announcement of the Webster Chemical company of St. Paul, Minn. This concern, which is favorably known all over the United States, as well as in many foreign countries, manufactures a chemical coloring for incandescent lamps, which can be easily and quickly applied by anyone. This coloring is permanent, and is said to produce more brilliant and lasting effects than colored glass. The Webster company, which placed its Crystal coloring on the market many years ago, has been successful in this line, and has received orders for its product from all over the world. It will be pleased to send a circular giving full information to those interested in this subject.

It is said that from the Omaha Exposition material purchased by the Chicago House Wrecking company a small-sized town could be built, power for manufacturing supplied, homes and offices furnished complete, fountains placed in public squares and the whole town lighted throughout by electricity. Special attention is directed to the electrical supplies, both new and of a second-hand nature, which are listed in a catalogue, No. 156, which will be forwarded by mail upon request.

Berthold & Jennings, St. Louis, manufacturers of poles and cross-arms, are doing an unusually large business. The company's products are said to be in use all over the country, and it is stated that the company's methods of doing business have been especially appreciated by those who have done business with the firm. Berthold & Jennings have been exceptionally busy of late filling orders from independent telephone companies, whose wants they seem to have been able to supply with satisfaction.

The Belden-Larwill Electric and Manufacturing company, Fort Wayne, Ind., manufacturer of the Belden arc lamp, reports that it is more than pleased with the success which the lamp has met. The Belden lamp is said to possess a number of features not contained in any other arc lamp, and as a consequence it has excited special interest among lamp users. The company has just issued a catalogue which excellently illustrates and describes its lamp. This pamphlet may be obtained on request.

M. J. Vought, La Crosse, Wis., has just issued a circular giving a brief description of the Vought incandescent-lamp hanger, which is said to have met with marked favor among users of incandescent lamps. Mr. Vought has placed on the market several improved styles of hangers which are also shown in the circular. The device is especially adapted for use in factories where light is often required in special places. It is largely used all over the United States, and it is said that the manufacturer is being kept busy filling orders.

The Western Electrical Supply company of St. Louis states that it is exclusive territorial agent for the Eddy Electric Manufacturing company, manufacturer of direct-current generators and motors, and it reports that the demand for this apparatus has exceeded its expectations. The small motors are of light weight, very compact, and of moderate speed, being well adapted for users requiring a small amount of power. The larger motors are of multipolar construction with cast-steel frame. The steel of which this casting is made is of high permeability, which enables a machine of given output to be constructed of light weight. The Western Electrical Supply company invites correspondence concerning this apparatus, and will be glad to send out details and printed matter illustrating the Eddy machines.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 28, 1899.

637,766. Means for Driving Dynamos from Car Axles. John L. Creveling, New York, N. Y. Application filed July 30, 1898.

An endless belt is arranged to pass over a sheave on the armature shaft and sheaves on the car axle, it being kept taut by means of a pivotally supported idler.

637,773. Constant-current Transformers. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed June 6, 1898.

There are combined primary and secondary windings capable of movement with respect to each other as the inductive action between the windings varies, due to changes in load, a body of fluid insulating material, a float arranged to support the weight of at least one of the coils and means for directing the movements of the moving coil.

637,778. Electromagnetic Instrument. Georg E. L. Grabe, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed August 4, 1899.

A closed casing, a part of which forms a yielding diaphragm, is combined with an electromagnet, circuit-changing means for controlling the circuit including the electromagnet, an armature for the electromagnet carried by the diaphragm and a vibrating member carried by the diaphragm.

637,785. Protecting Static Voltmeters. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 15, 1898.

Combined with an electrostatic instrument is an impedance in series relation thereto and to the source of energy, the impedance being sufficiently high to prevent the maintenance of an arc if the potential rise sufficiently to leap the air-gap between the fixed and movable members.

637,789. Combined Relay and Distributer. Kirk Himrod, Chicago, and John R. Tucker and Charles C. Hinckley, Aurora, Ill., assignors to the International Typal Telegraph company, Detroit, Mich. Application filed March 10, 1899.

The relay comprises a permanent magnet, two neutralizing coils, downturned pole-pieces, an armature normally maintained almost in contact with the pole-pieces and movable toward the coils, and means for adjusting the pole-pieces with respect to the armature.

637,794. Lightning Arrester. Talbert B. Hughes, Hawes Cross-roads, Tenn. Application filed June 22, 1899.

The device has a base, line-terminals, a switch element carried by each line-terminal, local terminals adapted for engagement by the switch elements, additional terminals in mutual electrical connection and adapted to receive the switch elements when disengaged from the local terminals, and a conducting-plate arranged to bridge the line-terminals.

637,806. Pneumatically Operated Contact Shoe for Electric Railways. Sam H. Libby, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed September 20, 1897.

In an electric railway combined with a traveling vehicle are electric motors, a contact-rail, a contact-shoe carried by the vehicle and adapted to make electrical connection between the rail and motors, and a pneumatic motor for moving the shoe out of contact with the rail.

637,812. Trolley. Frank H. Merrill and Frank P. Woodsome, Portland, Me. Application filed March 20, 1899.

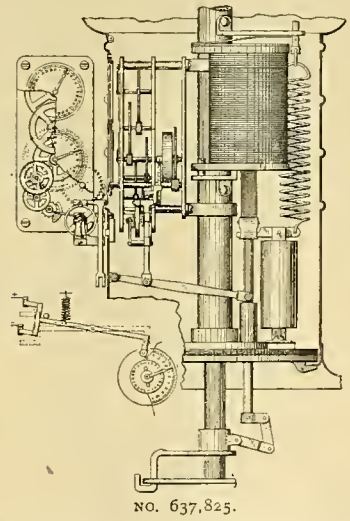
A swinging yoke with diverging arms and weighted base is pivotally attached to a bracket leading from the trolley head.

637,819. System of Distributing Alternating Currents. Ernst G. P. Oelschläger, Westend, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed September 19, 1898.

A source of alternating current is combined with a resistance equal or proportional to the resistance of the transmission line and inductance equal or proportional to the inductance of the transmission line, a transformer having its primary supplied with current from the transmission circuit, the secondary circuit of the transformer including the resistance and inductance, and a voltmeter included in circuit with a conductor receiving current from the main circuit, the conductor including the meter and secondary of the transformer in series, the inductance and resistance being also included in series with the conductor and meter, but in a branch connected in parallel with the secondary of the transformer.

637,825. Arc Lamp. Irving R. Prentiss, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 12, 1899.

The lamp is provided with a clock-train, a register operated thereby, means for releasing the clock-train when the lamp is burning and arresting it when the lamp is extinguished, and means for periodically automatically winding the clock-train. (See cut.)



NO. 637,825.

637,828. System of Electrical Distribution. Emil B. W. Reichel, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed October 15, 1898.

The system which is designed for electric traction combines a main source of current, a plurality of electric motors, the armatures of which are connected in parallel with the main source of current, a rotary transformer likewise connected with the source of current and adapted to supply a secondary circuit with a current of low potential with which the fields of the motors are connected, the fields being connected in parallel between the sides of the secondary circuit, and means for controlling the potential of the secondary circuit.

637,833. Electro-hygienic Apparatus. Anton Schneider and Andreas Schneider, Chicago, Ill., assignors to Charles L. Fortier, Milwaukee, Wis. Application filed March 17, 1898.

An exerciser comprising a movable electrode and retracting resistance is combined with a source of electricity generated independently of the exerciser, and automatic means for producing momentary pulsations of current through the electrode.

637,846. Electrical and Selective Signaling. John A. Barrett, Summit, N. J., assignor to the American Telephone and Telegraph company, New York, N. Y. Application filed June 8, 1899.

An apparatus is described which comprises an electromagnet and armature, a condenser in series with the electromagnet a normally open or discontinuous shunt around the electromagnet and condenser, and means for closing the shunt when the armature actuated by the magnet is moved from its normal or resting position in the field thereof.

637,873. Apparatus for Indicating Direction of Rotation of Motors. Hinrich Kähler, Hamburg, Germany. Application filed April 7, 1899.

The motion indicator is composed of a pair of contact arms adapted to be oscillated by a motor, a lever set by the shifting gear, an indicator, and electric connections between the indicator, lever and contact arms.

637,884. Telephone Circuit. Jörgen J. Möller, Kiel, Germany. Application filed June 2, 1893.

The system has a main line, a signal branch permanently grounded, a hand telephone-carrying lever normally connecting the latter to the main line, a three-point switch normally grounded, a branch in parallel with the signal branch including a hand telephone, terminating at the three-point switch and adapted to be connected to line through the lever, and a subbranch permanently grounded and adapted to be connected to line through the three-point switch branch containing the hand telephone and the lever. (See cut.)

637,886. Electric Arc Lamp. Gilbert L. Moyer, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed February 13, 1899.

In combination with the arc-striking mechanism of the lamp are a carbon clutch having clutch blocks upon opposite sides of the upper carbon, clutch yokes, one of which is connected with the upper parts of the blocks and the other of which is connected with the lower parts of the blocks, clutch-connecting arms, and a releasing plate connected with the arms.

637,890. Electrical Cut-out. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed June 28, 1897.

A cut-out is described which comprises a base and a cap of insulating material, fuse wire and the necessary wire connections.

637,891. Fusible Plug. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed June 30, 1899.

The plug consists of an insulating body, a cap having two plates with binding-screws for the connection of the branch wires, two arms for attachment to the body, walls of insulating material with a fuse wire passing over a wall of insulating material and connecting each plate with each arm.

637,892. Electric Switch. Charles G. Perkins and John Tregoning, Hartford, Conn., assignors to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed June 2, 1899.

A receptacle for an electric switch formed of insulating material is described.

637,894. Terminal-head Box. Henry E. Procunier, Chicago, Ill. Application filed March 29, 1899.

An inclosure for an electric terminal head is described which consists of a plate on which the terminal head is mounted, and a channel sheath having lateral slide-bearing engagements with the plate.

637,904. Exhibition and Musical Apparatus. Alfred J. Swaab and Rodolphe de Lamprecht, London, England. Application filed June 5, 1899.

An electric motor operates a traveling band or film and a phonograph in a coin-freed apparatus, and an incandescent lamp is provided for illuminating pictures on the band.

637,905. Changeable Electric-light Sign. Herman Tripp and George E. Stephenson, Chicago, Ill. Application filed June 19, 1899.

The sign combines a backing consisting of sections provided with slots, conductors in line with the slots, and letters provided with contacts passing through the slots and securing the letters to the backing and conductors.

637,914. Electric-alarm System and Apparatus for Testing Same. Edward F. Woodman, Boston, Mass., assignor to the National Fire Appliance company, Boston, Mass. Application filed March 9, 1899.

A protective system is described comprising a main alarm circuit including one or more devices to change the

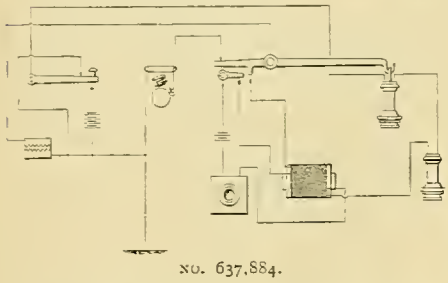
circuit under abnormal conditions, a test-indicating device therefor, one or more local circuits each having an indicating device responsive to a change in the main circuit, and a testing apparatus adapted upon operation to connect the test-indicating device with the main circuit, and through the latter to effect the operation of the local-circuit indicating device, whereby the condition of the main and local circuits will be indicated.

637,960. Electrically Operated Switch Mechanism. Samuel L. Foster, San Francisco, Cal., assignor to the Market Street Railway company, San Francisco, Cal. Application filed May 20, 1899.

In the invention are provided means electrically operated from a car approaching the switch-rail which transmit motion to a fulcrumed lever in order to actuate mechanism intermediate to the lever and the switch-rail.

637,979. Incandescent Electric Light and Process of Making Same. William L. Voelker, London, England, assignor to Theron Clark Crawford, New York, N. Y. Application filed February 28, 1898.

In the manufacture of filaments for incandescent lamps from carbide of uranium, means are described for increasing the electrical resistance which consists in adding to the uranium nitrate and cane-sugar solution a suitable proportion of titanium nitrate, the mass being ultimately reduced in the electric furnace.



NO. 637,884.

637,992. Electric Log Recorder. Levin T. Jones, Jr., San Francisco, Cal. Application filed August 4, 1899.

A distant counting mechanism operated by an electromagnet is connected with the registering apparatus of a log and a make-and-break mechanism carried by the log, the device being designed to indicate the speed of a vessel.

638,011. Electric Meter. Edward S. Halsey, Evanston, Ill. Application filed March 27, 1899.

A combined maximum and integrating electric meter is described which includes in its construction a rotating motor, a counting mechanism, a maximum indicator, a suitable device for preserving the maximum indication, the armature of the motor being revolved in a given direction by, and at a velocity in proportion to, the measured current, simultaneously operating the counting mechanism and by its force raising the indication on the maximum scale to the maximum amount passed through the meter.

638,026. Automatic Block Signal and Train-stopping Device. Samuel J. McCart, Appleton, Wis. Application filed June 3, 1899.

The device combines a track divided into insulated sections, a continuous electrical conductor extending along the track, a line having therein a source of electricity and an electromagnet, the terminals of the line being electrically connected with the track and with the electrical conductor respectively, a second electromagnet adapted to be energized by the closing of the first-mentioned line, a spring-actuated vertically movable rod adapted to be released by the energizing of the last-mentioned electromagnet, the rod carrying a valve on its lower end adapted to close the train air-pipe, a rock shaft carrying a valve adapted to close the steam-pipe, and a crank on the shaft connected to the upper end of the spring-actuated rod.

638,036. Electric Switch. Herbert P. White, Philadelphia, Pa. Application filed March 7, 1899.

The switch has a hinge member consisting of a base, upwardly converging walls extending therefrom and meeting substantially parallel upwardly extending walls, the walls being deflected and continued in substantially parallel direction downwardly and provided with diverging members at their lower portion which are adapted to impinge against the adjacent converging walls.

638,038. Primary Battery. Henry Blumenberg, Jr., and Frederick C. Overbury, New York, N. Y. Application filed December 12, 1898.

The battery cell and its cover are combined with suspending rods connected at their upper ends to the cover, a cup having side portions permanently secured to the suspending rods and a separate bottom removable from the cup whereby the depolarizing material can be discharged downwardly by removing the bottom without disturbing the connections of the cup to the cover. (See cut.)

638,039. Battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed April 7, 1899.

A battery compound of ammonium chloride and aluminum tersulphate is mentioned.

638,040. Battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed April 7, 1899.

The compound consists of sulphate of aluminum and chlorate of sodium.

638,041. Battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed July 20, 1899.

A compound of ammonium chloride and a bisulphate of the metals of the alkalies or alkaline-earth metals is set forth.

638,042. Battery Compound. Henry Blumenberg, Jr., New York, N. Y. Application filed September 8, 1899.

This compound consists of a chloride, a bisulphate and a chlorate of the metals of the alkalies or alkaline-earth metals.

638,047. Trolley-wire Cleaner. Robert Dunning, Buffalo, N. Y. Application filed March 14, 1899.

There is described a scraper adapted to be attached to a trolley-head which consists of a plate of concavo-convex cross-section which is curved to conform to the periphery of the trolley wheel and provided in its grooved or concave face with a transverse scraper rib or ribs and in the walls of the groove with openings for the escape of sleet and ice.

638,050. Electric Heater. Edward E. Gold, New York, N. Y. Application filed February 18, 1898.

In the heater are combined a resistant wire and a wire or rod forming a support therefor, opposite end heads connected together, each head formed with a recess in its outerside, the ends of the supporting wire passing through the heads into the recesses, and binding-posts mounted in the recesses for connecting the external circuit-wires to the terminals of the resistant wire.

638,053. Oscillating Meter. Albert Lotz, Berlin, Germany. Application filed December 29, 1897.

A wattmeter is described which combines current coils and a swinging shunt coil with relay mechanism in electrical connection with the moving parts of the meter, a register operated from the relay mechanism, whereby the disturbing frictional resistance to the motion of the oscillating parts is avoided, and contacts co-operating with the swinging shunt-coil for changing the course of current in the swinging shunt. (See cut.)

638,070. Dynamo-electric Machine. William B. Sayers, Bearsden, Scotland, assignor to himself and the Mayor & Coulson, Limited, Glasgow, Scotland. Application filed September 28, 1898.

The machine has an armature, a field magnet, with two or more poles and pairs of reversing pole-pieces arranged between the field-magnet poles and in proximity thereto so as to be magnetized initially thereby, the pole-pieces of each pair being magnetically disconnected from each other.

638,083. Chemical Generator of Electricity. Edward L. Anderson, St. Louis, Mo. Application filed October 4, 1898. Renewed September 16, 1899.

A battery is described which has a pair of electrodes, one of which is lead, and a solution of hydrofluoric acid.

638,084. Electrical Cut-out Apparatus. Leonard Andrews, Hastings, England. Application filed April 4, 1898.

An electric motor having a pivoted armature is adapted, when stationary, to hold circuit-breaking devices in position, and when partly rotated in one direction to release a trip and permit a knockout device to open the cutout.

638,085. System of Electrical Distribution. Leonard Andrews, Hastings, England. Application filed April 4, 1898.

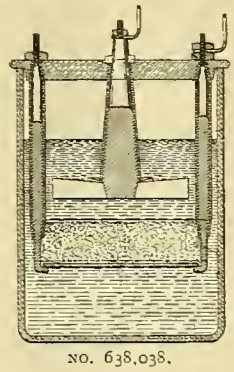
The system has a source of electrical energy, substations, feeders connecting the source with the substations, an automatically opening return current cut-out at each station, means for normally holding the cut-out closed, and a motor controlling the holding means and having series windings located in the feeder-circuit and each motor adapted to release the cut-out holding means only upon reversal of current in the feeder-circuit when the same is traversed by a current from the substation.

638,101. Telegraph Instrument. James L. Cutler, Cincinnati, O. Application filed April 7, 1899.

The instrument has a magnet composed of a coil, core and bent bar in combination with an armature of iron cut in two or more pieces and riveted to a brass or other diamagnetic back piece.

638,110. Starting Switch. John W. Gibbs, Liverpool, England. Application filed July 3, 1899.

The device has a separate arm or follower which is automatically returned to its position by a failure in the supply of current, the switch arm being free to be turned back by hand to vary the resistance as required.



NO. 638,038.

638,123. Electric Arc Lamp. Walter C. Johnson and Adolph Wunderlich, London, England. Application filed April 4, 1899.

In the lamp are combined a casing, a regulating solenoid having an armature movable in the latter, an upper carbon working freely in the armature, a carbon clutch composed of a loose plate, gravitating angular levers pivoted thereto and pins on the lower end of the armature to bear against inclined outer edges of the levers, and a cap piece attached to and closing the lower end of the casing and against which the loose plate rests when the armature is in its lowest position.

638,128. Electromagnetic Ore Separator. Emil Kreuser, Mechernich, Germany. Original application filed February 28, 1899. Divided and this application filed May 12, 1899.

The invention consists of a pair of oppositely revolving cylindrical electromagnets, and the combination with the polar surfaces of the one electromagnet of a closely fitting covering of non-magnetizable material, whereby the poles of this magnet are prevented from attracting the ore, while at the same time they co-operate in producing the necessary flux of magnetic lines of force, and also serve to convey the ore to and from the magnetic field.

638,129. Electromagnetic Ore Separator. Emil Kreuser, Mechernich, Germany. Application filed May 12, 1899.

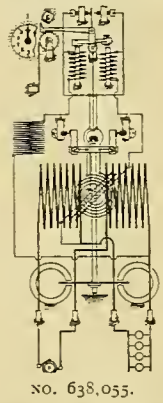
A device is described which maintains a constant polar distance between the two revoluble cylindrical electromagnets of the separator and also serves to transmit the rotary motion of one magnet to the other.

638,148. Electric Belt. Albert T. Sanden, New York, N. Y. Application filed February 18, 1899.

A combination pad and electric belt is described.

638,150. Means for Controlling Electrically-Moved Apparatus. Gaston E. Sautter, Paris, France. Application filed February 20, 1896.

The apparatus has an electromagnet and two armatures normally in equilibrium, two sectional rheostats electrically connected with each other, one constituting a manipulator and the other a receiver and each connected in series with one of the armatures, an electric motor, motor-reversing mechanism, means operated by the armatures for operating the motor-reversing mechanism, switch mechanism operated by the armatures for throwing in and out the motor-reversing mechanism, means for throwing any number of the manipulator rheostats into circuit to destroy the equilibrium of the armatures, and mechanism actuated by the motor for throwing the rheostats in the receiver into correspondence with the rheostats in the manipulator and thus restoring the equilibrium of the armatures and throwing the motor out of operation.



NO. 638,055.

638,152. Telephony. John S. Stone, Boston, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed December 15, 1896.

There is described a method of transmitting articulate and other sounds by developing a uniform oscillatory current of inaudibly high frequency in the primary of a telephone circuit by the disruptive discharges of a condenser in the primary, and varying the length of the spark gap across which such disruptive discharges occur in accordance with the sonorous vibrations of the sounds.

638,155. Electric Railway. Elizabeth Warwick, Chicago, Ill. Application filed March 18, 1899.

A conduit system of electric railways is described which combines a line conductor, a bracket substantially parallel therewith, a detachable cover, insulating blocks held between the bracket and cover and recessed to receive the conductor, and means upon opposite sides of the insulating blocks for securing the bracket, cover, blocks and conductor in position.

638,157. System of Electrical Distribution. Ernest Wilson and John M. Cater, London, England. Application filed June 16, 1899.

The system comprises a main generator, a storage battery in parallel therewith, a work circuit supplied with current from the generator and battery, and an additional generator provided with differential magnetizing coils, the armature and one of the coils being joined in series with the work circuit being connected between a common terminal of the battery and main generator and a terminal of the work circuit.

638,159. Carbon Holder for Electric Arc Lamps. Frederic S. Worsley, London, England, assignor to the British Blahnik Arc Light company, Limited, London, England. Application filed November 22, 1897.

The device consists of a permanent socket and a removable bush threaded into the socket, and which pinches the carbon.

638,160. Electric Clock. Hjalmar E. Andersson, Stockholm, Sweden. Application filed February 16, 1899.

With the time train and striking mechanism of a clock, and a motor spring for the time train are combined electrically controlled appliances for operating the striking mechanism organized to partly wind the motor spring at each revolution of the escapement wheel and at each blow struck by the hammer of the striking mechanism.

638,170. Illuminated Car Sign. George F. Bostwick, New York, N. Y. Application filed August 3, 1898.

An electrically illuminated sign is described.

638,186. Surface-contact Electric Railway. David Robertson, Jr., Uddingston, Scotland. Application filed June 9, 1899.

A system of electrical traction of high and low potential is described consisting of a main skate and an auxiliary skate on the car, studs along the track adapted to make contact with the main skate and connected to an operating switch and high potential circuit in combination with switch-contact studs adapted to make contact with the auxiliary skate and connected to the low-potential circuit auxiliary studs so placed that some of them may make contact through the auxiliary skate with a switch-contact stud, at all times, and thereby operate the switch.

638,199. Electric Switch. Frank A. Merrick, Johnstown, Pa., assignor to the Steel Motor company of Ohio. Application filed September 24, 1898.

The inventor describes a canopy switch consisting of a switch shaft, a plurality of arms on the shaft, contacts carried by the arms, an operating handle, a cap with lugs adapted to be engaged by the handle, and a torsion spring having vertical shanks.

DESIGN.

31,898. Electromotor Casing. John Post, New York, N. Y. Application filed October 30, 1899. Term of patent, seven years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, DECEMBER 16, 1899. No. 25

Orleans Underground Electric Railway in Paris.

By A. de Courcy.

Two important underground electric-railway systems are now under construction in Paris, the Metropolitan and the Orleans. The latter has been constructed with a view of making the depot of the Orleans railroad, which lies toward the eastern part of the city, more accessible and thus increase the suburban traffic. The line commences at the railroad station, which is on the left bank of the Seine, near the Austerlitz bridge, and continues along the banks of the river to the new Alexander III. bridge at the Exposition grounds.

The construction of this road presents many points of interest, both from an engineering and an electrical point of view. Leaving the railroad station, the line passes under the Austerlitz bridge by a short section of tunnel, shown in Fig. 2 (p.350). It then proceeds between two walls for about half a mile. The tunnel then recommences, following the Seine from the Sully bridge to a point nearly opposite Notre Dame, where the construction takes the form shown in Fig. 1, which is a view taken toward the St. Michel bridge. A different construction is here used, the old wall of the quay having been torn down and replaced by a similar wall, with the arched openings, shown in the figure. A second wall runs parallel to this on the inner side, and upon the two walls are laid heavy I-beams, with a brick-arch construction between them. In this way the pavement is upheld and the general appearance of the quay is about as before.

FIG. 1. ORLEANS UNDERGROUND ELECTRIC RAILWAY IN PARIS.—CONSTRUCTION ALONG THE SEINE, OPPOSITE NOTRE DAME.

Continuing along the river bank to the Pont Neuf, where the tunnel again recommences, the road leads to the main station on the Quai d'Orsay. This railroad station will be of great size. A recent interior view, showing the work in progress, is given in Fig. 3. The tracks enter at the lower level, while the platform above represents the floor of the building at the street grade. Fifteen tracks will cover the ground shown in the picture, connecting with the double track of the tunnel. Twelve of these are for the use of the public and are reached by six footways, which are raised to the same height as the floor of the car. The superstructure will be a large and handsome building of gray stone, which is to be a depot and hotel combined.

The cars to be used on the underground system are of the same type as those of the main railroad, and it will be necessary to provide electric locomotives of considerable size and power. The railway company, when considering the system of traction to be adopted, sent a committee of engineers to the United States to examine the conditions of traction and the practicability of using large electric locomotives. Upon the favorable report of this committee the system of electric locomotives was adopted. As these are to be of considerable length, they will be provided with front and rear trucks of four wheels each. The axles of each truck will be driven by a separate motor, this giving four motors for each locomotive. The motors are geared to the axles by single-reduction gearing.

Current will be taken from a conducting rail insulated upon paraffin blocks and running parallel to the main rails upon the same ties. This third rail will be placed in most cases on the outer side of the road, but in crossings and in special cases it will be placed on the inside or between the main rails, as may be required by the conditions of running. To provide for these different positions each locomotive will have three rubbing contacts on each end, so that the current will be taken in any position of the conducting rail. The locomotive will not be turned at the end of the route, but will be provided with a controller at each end. The controllers are of the series-parallel type, with magnetic blow-out.

The main generating station will be installed near the Tolbiac bridge, to the east of the railroad station. The three-phase system will be used, and the transmission will be made at high potential to two sub-stations, giving the necessary power for the road, as well as the lighting current. The main station will have two alternators of 1,000 kilowatts each, giving 5,500 volts at 25 cycles. The first of the sub-stations will be located at the Austerlitz bridge and the second at the Quai d'Orsay. Each of these will have two groups of rotary transformers, one of which will transform the current at 5,500 volts to 550 volts direct current for the traction circuit, and the second group will give 500 volts for the lighting and auxiliary circuits in the tunnels and stations. A battery of accumulators will be connected in parallel across the bus-bars of the traction circuit, furnishing a reserve, which will help out the machines when subjected to sudden strains, thus regulating the distribution of load.

The conversion of alternating current at 5,500 volts to 500 volts direct current for the lighting circuit is effected by two groups, each of which consists of a three-phase synchronous motor taking the full potential, direct-coupled to a 500-volt generator. This arrangement will have the great advantage of freeing the lighting circuit from the variations due to the traction circuit, as the synchronous motors, keeping the same speed as the main alternators, will drive the generators at a constant voltage. Each of these two groups will have a capacity of 100 kilowatts. Nearly all the arc lamps and many of the incandescents will be grouped in series on 500 volts. For the primary distribution at 5,500 volts, armored cables, having three conductors, will be used. They will be buried in trenches or laid in conduits of masonry.

American Society of Mechanical Engineers.

The twentieth annual meeting of the American Society of Mechanical Engineers was held in New York from December 5th to 8th. A large number of gentlemen were in attendance at the sessions, which were presided over by the president, Rear-admiral George W. Melville, U. S. N. The annual address of the retiring president was on "Engineering in the United States Navy." Among the many valuable papers read and discussed at the different sessions of the meeting were the following: "The Steam Engine of the Nineteenth Century," by R. H. Thurston; "Compression and Liquefaction of Gases," by Arthur L. Rice; "An Efficiency Test of a 125 Horse Power Gas Engine," by C. H. Robertson; "Friction Tests of a Locomotive Slide Valve," by F. C. Wagner, and "The Value of a Horse Power," by George L. Rockwood. The election of officers for the ensuing year resulted as follows: President, Charles H. Morgan; vice-presidents, E. D. Meier, George R. Stetson, B. H. Warren, Jesse M. Smith, Stevenson Taylor and David Townsend; managers, George Richmond, James B. Stanwood, H. H. Suplee, E. C. Felton, A. M. Goodale, R. H. Sonle, F. H. Boyer, John A. Brashear and Alfred H. Raynal; treasurer, William H. Wiley; secretary, F. R. Hutton. The time of the next annual meeting, according to custom, will be decided at a later date, as will be the time and place of a semi-annual meeting or convention to be held next May or June.

Train Lighting.

At a recent meeting of the Southern and Southwestern Railway Club, Mr. W. E. Symons, for a committee consisting of himself, R. H. Johnson and T. S. Lloyd, presented an extended report on the comparative value, efficiency, cost and practicability of the various types of artificial lights for passenger cars. The report is taken up with descriptions of storage-battery, axle-light, direct-dynamo, combination dynamo and storage and Pintsch-gas systems. In summing up, says the Railway Master Mechanic, the committee finds that the oil lamp, with its offensive odor, annoying heat in hot weather, danger from fire or explosion, either in train accident or otherwise, is fast becoming obsolete, except on some branch or local runs where it would be impossible to use the electric light, the cost being prohibitive, or where, from the lack of storage stations, gas cannot be procured; while on all first-class trains in main-line service, it would appear that either gas or electric lighting of some system was the standard. Electricity has passed the experimental stage, says the committee, both as a power and as an artificial light, "and even if stopped in its development where it now is, it must be considered as one of, if not the greatest invention of the age, and certainly one of positive and enduring utility. That the unknown capacity of the American inventive genius will doubtless cheapen the production to a degree that will practically make its adoption universal we all hope for, and feel assured will be realized at a not far-distant day. Owing to the development of electric and other means of artificial lights, none of these figures as to the cost should be considered as permanent or fixed, for from the strides that have been made, particularly in the reducing of the cost of production, no doubt the cost of electric and other up-to-date improved methods of artificial light for trains will be still further materially reduced, until they will be equally as cheap as or cheaper than the oil lamp or tallow candle."

The committee gives the following memorandum as to cost of application and maintenance of mineral-seal-oil lighting on the Plant system: Cost of lamps, two chandeliers of two lamps each to a car, $172.50; oil consumed for lighting periods of 12 hours, one gallon per car; average cost per light per hour (12-hour period), 0.025.

It also gives the proportion of the various systems of lighting passenger cars in the United States (Railroad Gazette statistics):

Oil lamps	55 per cent.
Gas	43 per cent.
Electric light	2 per cent.

The following average costs per light per hour are also given by the committee:

Storage straight	0.007
Dynamo straight	0.083
Dynamo and storage	0.043
Gas (Pintsch)	0.02

Figures as to the axle light and the acetylene gas were not available.

The Rhinelander (Wis.) Lighting company has been granted a franchise for electric lighting for 10 years.

Electricians Working and Fighting in the Philippines.[1]

By Harry A. Armstrong.

Manila, October 30.—D. T. Flannery is a private in the Signal Corps and he is of many years' standing. He has grown gray in the service and has reached the distinction known as a first-class private. But he never saw a hotter time than on the south line during the first few days of this month. It was when the insurgents were very bold there and were cutting the wire between Imus and Bacoor at their own pleasure.

The breaks were always in the vicinity of the "big bend" of the Imus River, and it became Flannery's business to see that the wire was in working order and that communication with Manila was kept intact. There were a few days when nothing happened, and it was thought to be a good time to put in a telephone system at Imus, connecting the headquarters with the different points of official importance about the town. To get the wire and instruments the lineman came into Manila. He took back with him Private Frank R. Beale of E company. The boat was then running to Bacoor, so they loaded their wire on the launch and went across. From Bacoor the two Signal Corps men took a little cart and drove to Imus. Nothing happened on the way, and the beautiful road around the "bend" seemed to hold nothing more dangerous than a frightened carabao.

The men reached Imus about one o'clock, the journey by land and water having taken four hours. Flannery reported to Major Price, commanding the troops at Imus. He was given a horse and told to place the instruments. This was accomplished by 3:30 o'clock. About this time two companies of the Fourth Infantry that had gone out on a reconnoissance got into an engagement. Flannery was on a horse, and he rode out to where the fighting was going on. There he met Major Price and offered to do any work that might be wanted. Major Price told the soldier to report to Captain Browne, then in charge of the fighting. Captain Browne made him mounted orderly and sent him all about the field with orders. At last the insurgents were driven away and the fight was over.

Beale heard the fighting and started out on foot. He got there and was ready to do anything needed of him. But he was not mounted, and about all he could do was to admire "Pop," as Flannery is known to the men.

Major Price and Captain Browne were so well satisfied with the thoroughness of the Signal Corps man and his work that both took occasion to tell him that he had done well. This opinion they later embodied in a report to the commanding general—which was more to the point.

As soon as the fighting was over the men went back to fixing the telephone. They kept at the work until October 2d, when they again heard firing out toward the east, and bullets came thick into the town. It was discovered that the linemen were in the zone of fire, but they did not stop work. They connected the offices of headquarters with the adjutant's place and then with the arsenal. It was just at this time, the hour being about 11 o'clock in the forenoon, that the order came to Flannery to take some help and repair the telegraph line in the vicinity of the "big bend." Flannery took Private Beale, two Chinese carriers and an armed sentry, and set off for the break. It took them half an hour to get there.

When they got near the place they overtook an infantry company and scouts from the Fourth, stationed at Imus. Twenty men were sent along as an escort. Before reaching the break the insurgents opened fire and drove the guard back to the rear and the main column. The situation was critical. The officer in command of the troops wanted to know if Flannery had an instrument by which he could receive and send messages.

"I have not," said Flannery, "but I can send the message to Imus, sir, if necessary. If the current isn't too strong," he continued, "I can receive messages through my tongue."

Flannery took two ends of the wire and sent the first message. He merely tapped the ends of the wire together, making the dots and dashes. The ground end was twisted around a bayonet which was thrust into the earth. But this sort of thing was too strong for the tongue, as Flannery found when he received the "O K" from the operator at Imus. Two bayonets were thrust into the ground and so the current was divided. But still it was too strong for the lineman. He could send, however, and he did send another message by tapping the ends of the wire together in the code of dots and dashes. The "O K" he received through his hands. The current was strong enough for that.

The messages had asked for re-enforcements, and soon a company of the Fourteenth came up from Bacoor, and shortly after a like number of soldiers came from Imus. With this force it was deemed practical to fix the break. Privates Miller and Barrett had joined Flannery and Beale, and they all went out to do the work. Flannery was making a rapid tie when the company of the Fourteenth swung around and uncovered the position of the signal men. Then the company unceremoniously marched off to Bacoor and called to Flannery, asking him to tell the company of the Fourth that they had gone. The signal men now were without support, and fully 400 yards ahead of the trenches of the troops which stuck to the field. They were much closer than that to the insurgents. In fact, the voices of the insurgent officers were heard giving orders and the insurgent soldiers were in plain sight across the river. Flannery thought it was time to retire. The bullets were coming thick and close to his little bunch of men. He hastily completed the tie and threw the coil of wire across the road and fence so that it could be pulled into the trench. Then he told the men to get to cover. When the men cleared the fence the volleys came at them. Private Beale stumbled headlong. Flannery caught him and helped him on into the trench and comparative safety. Then it was discovered that Beale had been shot in the leg. A call on Imus was made for an ambulance, and Flannery turned his attention to his wounded companion.

Heavy volley and line firing was heard in the direction of the bend. Suddenly Lieutenant Cunningham sprang into the trenches. Behind him came Sergeant Brown. Both were of the Signal Corps. Cunningham was on foot, his horse having been shot from under him as he passed the bend and exposed himself to the insurgent fire. They had come from Bacoor. Flannery reported at once to the lieutenant and told him of the wound Beale had received. Then the ambulance came and the old lineman took the wounded man back to Imus. When Flannery reached there it was six o'clock, and he remembered that he had had no dinner.

Cunningham stayed on the ground, sending Sergeant Brown to Imus for a coil of wire. It was his intention to run the wire past the bend in the night, but it started in to rain and the night was too dark to work at all. The work was done in the morning, but the connecting wire was run behind the hedge of bamboos that fringes the road. Helping him the lieutenant had, besides Brown, Sergeant Berry and Privates Whitcomb and Guswaler.

That day the troops came down and flanked the enemy and drove them south, taking possession of the trenches that had been occupied by the insurgents and planting them with American outposts. This was on October 3d. The day before Corporal Gunderson had been mortally wounded at that place.

"Pop" Flannery is now on the north line, and has been selected to go with General Lawton on his march north.

1. From the Chicago Record.

FIG. 2. ORLEANS UNDERGROUND ELECTRIC RAILWAY IN PARIS.—MOUTH OF TUNNEL UNDER AUSTERLITZ BRIDGE (SEE PRECEDING PAGE).

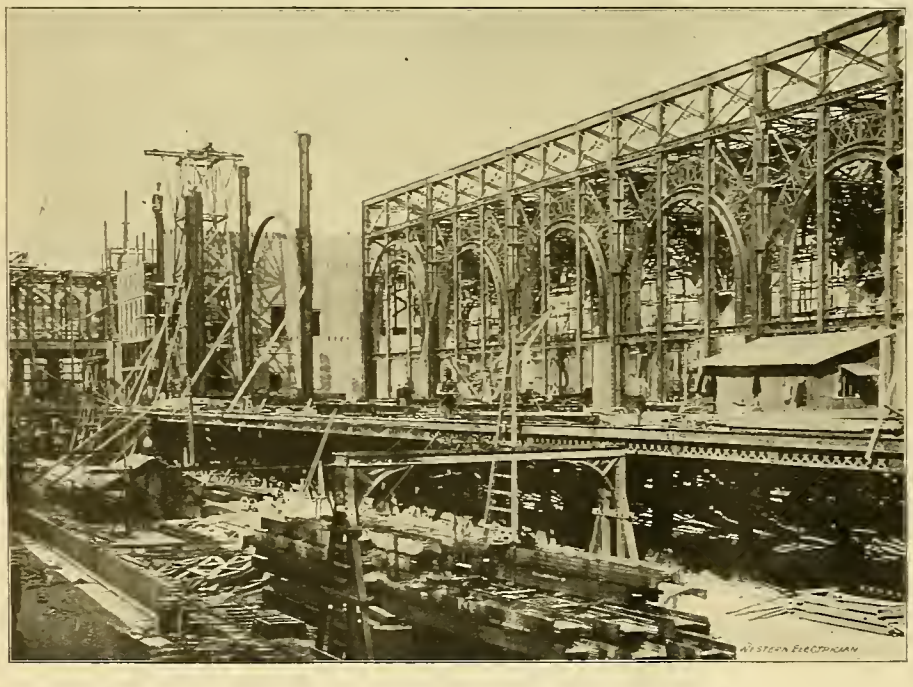


FIG. 3. ORLEANS UNDERGROUND ELECTRIC RAILWAY IN PARIS.—WORK ON THE STATION AT THE QUAI D'ORSAY (SEE PRECEDING PAGE).

Gas-engine Builders Organize.

The National Association of Gas and Gasoline Engine Manufacturers, composed of persons "actually engaged in the manufacture of internal-combustion engines," has been organized. The annual meeting will be held in February and meetings will be held in May, August and November. The officers are: President, S. E. Baker of the Foos Gas Engine company of Springfield, O.; first vice-president, R. G. Weber of the Weber Gas Engine company of Kansas City, Mo.; second vice-president, R. L. Kenah, Jr., of the Pierce-Crouch Engine company of New Brighton, Pa.; treasurer, C. D. Hudgens of the Columbus Machine company of Columbus, O.; secretary, A. S. Rodgers of the Springfield Gas Engine company of Springfield, O.

The new electric-light plant at Huron, S. D., began operations December 1st.

Imperial Central-station Plant in St. Louis.[1]

By H. H. Humphrey.

The Keyes ordinance passed by the Municipal Assembly of the city of St. Louis, Mo., in the fall of 1896, threw open the doors to all applicants for underground-conduit rights. Fourteen companies appeared at the first hearing before the Board of Public Improvements and made formal application for space for electric wires beneath the surface of the streets. Among the applicants were several newly organized companies, and one of them has since constructed its plant. The Imperial Electric Light, Heat and Power company first turned current into its underground system one year ago, October 15, 1898, and has been in continuous and successful operation since that date. This paper is a discussion of the design and construction of this plant, which embodies many interesting features.

In order to reduce the first cost of station equipment and underground work, both conduits and cables, it was deemed advisable that all three kinds of service [power, and arc and incandescent lighting] should, if possible, be supplied from one generator, delivering its output through one underground duct and one service cable. These considerations led to the adoption of a three-wire direct-current system of distribution, differing in important details, however, from the methods heretofore employed. Two hundred and twenty-volt incandescent and 220-volt arc lamps were both to be used on the sides of the three-wire system, while 500-volt motors would be connected directly across the outside wires. By the proper use of boosters with storage batteries at the ends of feeders, such a system may be extended over a district within a radius of 10 miles from power plant.

Hypothetical load curves were prepared, covering the service expected from this plant, including incandescent and arc lights and motor service. The three were then combined into one curve representing the entire anticipated output of the plant under the heaviest service of the winter months. (See Fig. 1.) A study of this curve indicated that the number of units in the plant should be at least five. This number fitted both the minimum load, which was about one-fifth of the maximum, and provided admirably for reserve. In case of accident during

FIG. 1. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.—HYPOTHETICAL AND ACTUAL LOAD CURVES.

the peak of the load, the other four units could take the place of the disabled one by each carrying 25 per cent. above its rating. In case of the adoption of a storage battery sufficiently large to carry the reduced load during the latter part of the night, and assist the generators during the times of maximum load, it was deemed safe to reduce the number of units to three, the battery to be of the same capacity as each of the units.

Building.

The plant is located at the southeast corner of Tenth and St. Charles streets, on a lot having a frontage of 142 feet six inches on St. Charles street, by 85 feet 2½ inches on Tenth street and 92 feet 3⅛ inches on the east line. An exterior view of the building is shown in Fig. 4 (page 352). Fig. 2 gives a sectional view of building, and Fig. 3 a plan of the engine and dynamo room.

The building is of brick, three stories high above the basement and of same dimensions as the lot above street level. The area under sidewalks on both Tenth and St. Charles streets is excavated to the curb line, which forms the outer line of retaining wall. The second story is omitted everywhere except over the main office, thus giving a clear height in the engine and boiler rooms of 30 feet. The third story, which is 15 feet high, is devoted to store rooms, testing department, etc. The entire structure is fireproof. Engine and boiler rooms extend the entire length of the building, and are separated by a division wall having fire doors at all openings. Beneath the engine room are the storage batteries, extending partly under the sidewalk. Beneath the boiler room is space for coal storage, ash handling and the location of condensing apparatus and piping. The floor of engine room is laid with hexagonal tile, and the walls for six feet above the floor are wainscoted with marble. The main offices of the company occupy the Tenth and St. Charles street corner on the first floor. The private offices are in the second story, directly above. An elevator at the east end of the boiler room runs from basement to third floor.

1. Abstract of paper read before the Engineers' Club of St. Louis, October 18, 1899, and published in the Journal of the Association of Engineering Societies.

Boilers.

There are four Heine boilers (Fig. 6), arranged in batteries of two each, with one stack between them, and economizers in the rear of and above the boilers. Each boiler contains 171 3½-inch water tubes 16 feet long. The total square feet of heating surface of the four boilers is 10,872. Each boiler has a rated capacity of 11,250 pounds of water an hour with feed water from the economizers at 200° Fahrenheit, into dry steam of 175 pounds pressure above atmosphere, and is guaranteed to be capable of developing continuously one-third more. The boilers are designed for a working pressure of 175 pounds per square inch. Each boiler is equipped with down-draft furnace. A feature of these furnaces which is original with the engineers is making the fire doors open the full width of the furnace, greatly facilitating inspection and care of the fires. Two additional Heine boilers of the same capacity are now being installed.

Chimney.

The present boilers are served by one steel stack (Fig. 8) seven feet inside diameter, 140 feet high above street level. The design of the complete

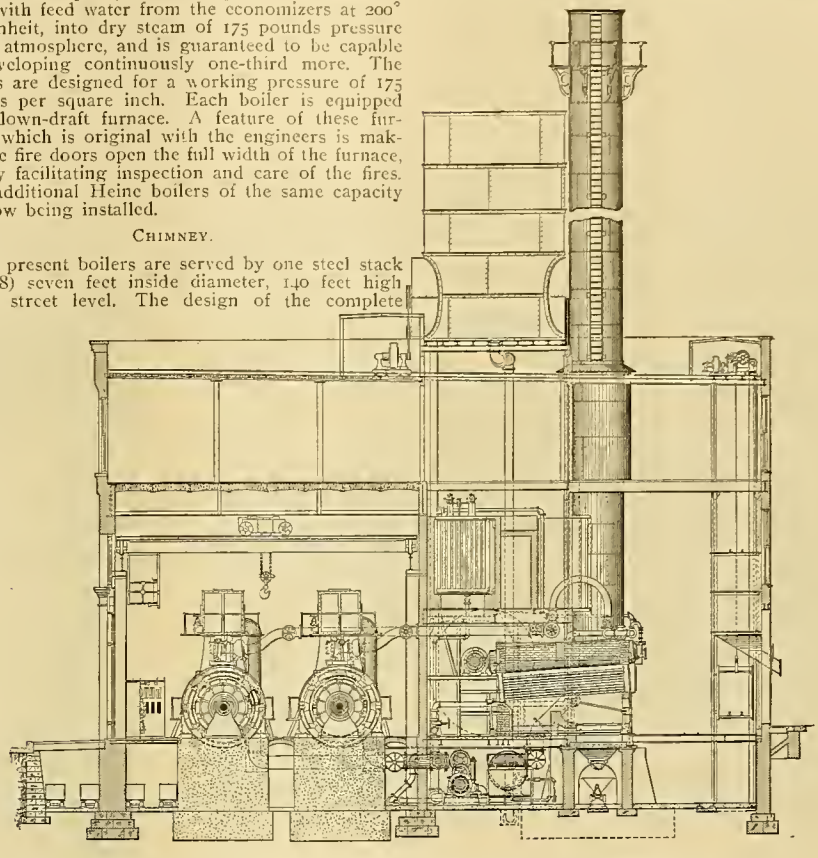


FIG. 2. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.—CROSS-SECTION.

plant provides for another seven-foot or eight-foot stack for the additional boilers, which are to go in. The present stack is self-supporting and unlined. The base is supported upon and rigidly bolted to a massive brick foundation 14 feet deep, and which is solid except for the ash-car passage, which extends through it. Through the third story of the building the stack is surrounded by a sheet-steel casing which provides ventilation for the boiler room. There is an improved draft gauge by which the draft can be read to thousandths of an inch at eight different points, including ash-pits of four boilers, two breechings, inlet to draft fan and base of stack.

Mechanical Draft.

In order to counteract the effect of the economizers in cooling the gases from the boilers, and to permit crowding when necessary, a mechanical-draft system was installed. It is of the induced type, the fan being placed directly behind the stack and between the two batteries of boilers. The fan is driven by means of a direct-geared electric motor, designed to be operated at different speeds on either the 235 or 470-volt circuit. This motor is to be controlled automatically, so as to maintain the steam pressure practically constant, the regulator slowing down the motor as the steam pressure rises and increasing its speed as the pressure falls. The capacity of the fan is sufficient to handle the waste gases from four boilers and furnish a draft equal to one inch of water where the gases leave the boilers. It is capable of being speeded in emergencies sufficiently to give a draft of 1½ inches on all four boilers.

Fuel Economizers.

There are two Green fuel economizers, each consisting of 320 pipes, the combined heating surface being 7,680 square feet. The economizer plant is capable of heating regularly and continuously 45,000 pounds of water per hour 100° Fahrenheit when receiving the water at 110° Fahrenheit, and with the temperature of the escaping gases leaving the boilers at not less than 450° Fahrenheit. These economizers are designed for a working pressure of 200 pounds to the square inch, and were submitted to a hydrostatic test of 300 pounds after erection in position. They are provided with automatic scrapers operated by electric motors. The economizers, as shown on the plan, are located in the rear and above the boilers, supported upon a substantial iron framework and bricked in air-tight by eight-inch walls.

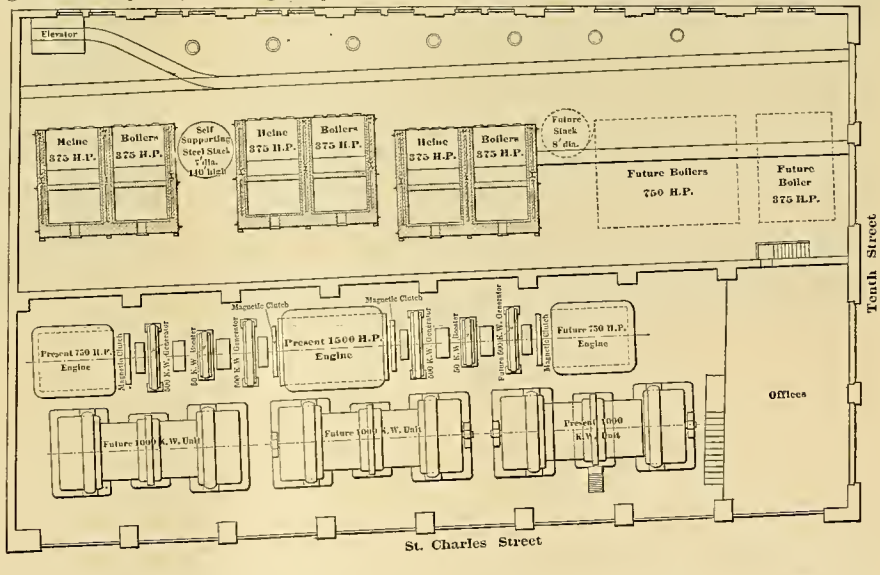


FIG. 3. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.—FLOOR PLAN OF BOILER ROOM AND ENGINE ROOM.

Coal and Ash-handling Machinery.

The coal and ash-handling plant is of simple and economical design, and consists of a system of

cars, tracks, elevator and overhead ash-bin. The cinders and ashes from the lower grates drop directly into a metallic ash hopper under each boiler. Running east and west, immediately under these hoppers, there is a narrow-gauge track. The ashes are dumped from these hoppers into small cars and pushed by hand along the track to an elevator, on which they are carried up and dumped into an overhead ashbin, from which they run by gravity into the wagons in the alley. Any ashes which accumulate in the stacks may be emptied directly in the cars in the same manner.

The entire space in front of the boilers in the basement is reserved for coal storage, the fuel being dumped through openings in boiler-room floor. The coal is taken from this storage room in the same cars, tracks being provided the entire length of the coal-storage space. It is then hoisted on the elevator to the floor above and distributed on tracks over the entire length of the boiler room in front of the boilers.

Steam Engines.

There are now in operation two engines (Fig. 7) of the Williams vertical two-cylinder cross-compound condensing automatic cut-off pattern, built by William Tod & Co. of Youngstown, O., and designed for direct-connection to the dynamos and shafting. The east engine, No. 1, is of 750 indicated horse power, and is designed for driving one 500-kilowatt generator at the most economical rating of the engine when operated at a speed of 150 revolutions per minute and supplied with steam at 170 pounds initial pressure per square inch at the throttle valve, and exhausting into a 24-inch vacuum. Engine No. 2 has double the capacity and is similar in design to No. 1. The heavy flywheels are located between the A frames supporting the high and low-pressure cylinders. Each engine is so constructed as to be capable of operating continuously at double its rated capacity, and for short intervals only at one-third above its double-rated capacity. The cylinders and all bearings are lubricated by the Siegrist lubricating apparatus, which delivers the two kinds of oil to the cups under pressure automatically maintained by duplicate steam pumps. They also have hand oil pumps for additional safety. The cylinders have flat multiported valves driven directly from the eccentrics. These engines are provided with shaft governors operating upon the valves of the high-pressure cylinders. When running with about 170 pounds pressure at the throttle, at 150 revolutions per minute and under a constant load at their rated capacity, the engines are guaranteed not to consume more than 15 pounds of water per indicated horse power hour.

The principal dimensions: Engine No. 1—Cylinders, 18 inches and 40 inches by 30 inches; diameter steam pipe, eight inches; exhaust, 15 inches; diameter crank shaft, 12 inches; length of bearings, 21 inches. Engine No. 2—Cylinders, 36 inches and 57 inches by 30 inches; steam pipe, 10 inches diameter; exhaust, 18 inches; diameter crank shaft, 16 inches; length of bearings, 28 inches.

Another 1,500 horse power engine, designed and built by the Lake Erie Engineering Works, Buffalo, N. Y., has just been installed. The dimensions of cylinders are 23 inches and 48 inches by 36 inches; speed, 120 revolutions per minute.

Condensers, Pumps and Cooling Tower.

The condensing plant consists of one Worthington surface condenser, one Worthington cooling tower, two combined air and boiler-feed pumps and two circulating pumps of the rotary type. The rated capacity of the plant is 33,750 pounds of steam per hour, but it will take care of overloads up to 49,500 pounds per hour with but slight reduction in vacuum. It is guaranteed to produce a vacuum of not less than 22 inches at above rating and under the worst conditions of service; 25 inches under fair and average conditions, and 26 inches under the best. These conditions vary with the humidity and temperature of the air. The condenser has 34,000 square feet of brass-tube cooling surface.

The cooling tower, shown in Fig. 8, is located on the roof. It is 18 feet in diameter, 29 feet high, and its filling or cooling surface is composed of galvanized-iron-pipe cylinders. It has duplicate fans located on opposite ends of the same shaft drawing air into the tower. These fans are driven by a belted motor in pent house on top of building.

There are two combined air and boiler-feed pumps; one of sufficient capacity to handle the water required by the 1,500 horse power engine, and the other of sufficient capacity for the 750 horse power engine, and two independent rotary circulating pumps of the same capacities. These pumps are driven by direct-geared motors, so designed that the speed may be varied at least 33⅓ per cent.

There are also two injectors for reserve-boiler feeds, each having a capacity of 11,250 pounds of water per hour, and capable of handling water of any temperature below 125° Fahrenheit.

Power-transmission System.

The engines and generators are connected by means of a patented system of power transmission (see Figs. 3 and 7), consisting of quills and internal shafts with double bearings, connected by magnetic clutches. The arrangement is intended to make it possible to drive any one, two or all three of the 500-kilowatt generators, and either one or both of the boosters, from the large engine in case of accident to the small engine. Two generators and one booster may also be handled by the small engine in case of accident to the large one.

The generators are connected to the engines by means of magnetic couplings, so arranged that either intermediate generator or booster may be disconnected from one engine and connected to the other while all are in motion. When it is desired to start up a generator, it is brought up to speed as a motor and then connected to the engine by the magnetic clutches.

Pipe Work.

All pipe above three inches in diameter has flanged couplings and fittings. All bent pipes are made of steel, and bent hot and of long radius. All valves on live-steam pipes and on the feed-water connections under boiler pressure are bronze seated. All valves above 10 inches in diameter are by-passed. The cylinder jackets, reheaters, separators, steam headers and the entire pipe system is drained by means of the Holley system, returning the water directly to the boilers. There is a combined hot well and oil filter located between the condenser and boiler-feed pumps. All the pipes are covered with magnesia. Each pump has a Cochrane separating receiver, located near the main throttle valve.

Crane.

The engine room is spanned by an electric traveling crane (see Fig. 2), with independent motors on the lifting, traveling and transfer motions. The capacity of the crane is 15 tons at 10 feet per minute, and it has a maximum speed of 30 feet a minute at

Fig. 4. Exterior View.

Fig. 5. Switchboard.

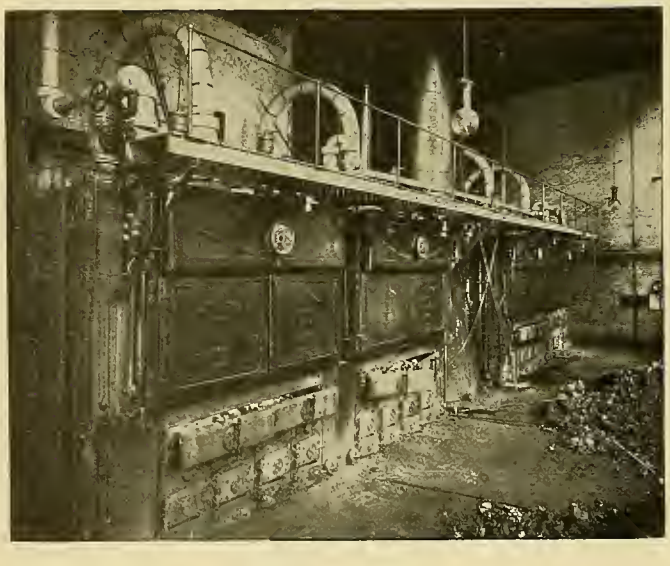


Fig. 6. Boiler Fronts.

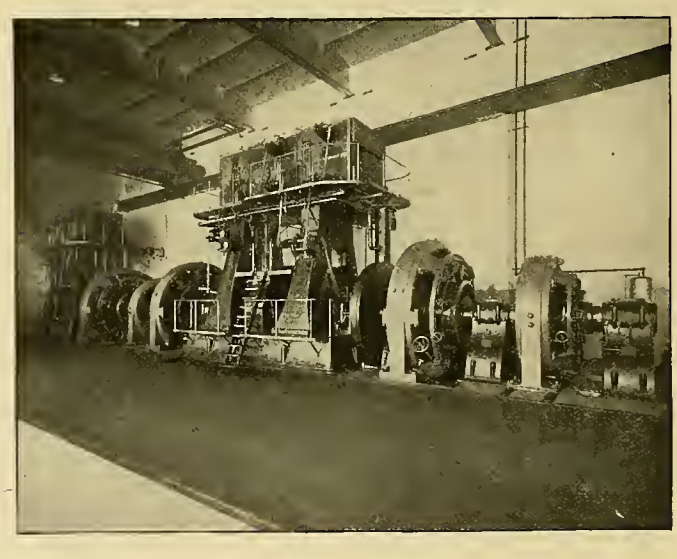


Fig. 7. Engines and Generators.

IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.

lighter loads. The maximum speed of travel is 80 feet per minute, and the maximum transfer speed 40 feet per minute. The motors are of 20, 15 and five horse power respectively, and are designed by the manufacturer as a part of the crane and built substantially into the framework of the structure.

Generators and Boosters.

There are three 500-volt constant-potential electric generators, built by the Siemens & Halske Electric company of America, of the internal ironclad-armature type. They are designed especially to fit the system of power transmission adopted. The field frames of the generators may be slid parallel with the shaft a sufficient distance for reaching the armature for repairs. The capacity of each generator is 500 kilowatts at 525 volts when operated at

FIG. 8. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.—CHIMNEY AND COOLING TOWER ON ROOF.

150 revolutions per minute. At this rating the rise in temperature of the armature will not exceed 40° Centigrade; of the field, 35° Centigrade; of the commutator, 50° Centigrade. The generators are guaranteed for an overload of 25 per cent. for two hours, and 33⅓ per cent. for one hour, with a 50 per cent. momentary overload without injurious sparking.

There are two separately excited shunt-wound boosters, each of 50-kilowatt capacity at 150 revolutions per minute, and capable of carrying 500 amperes and delivering any voltage from zero to 130 volts. The boosters are of the same general construction and design as the generators, except that the field frames are divided vertically. Two more generators of the same capacity are being made at present by the same company.

Switchboard.

The plant contains a composite switchboard (Fig. 5) of black marbleized slate, containing three generator panels, one booster panel, two battery panels, one wattmeter panel, three feeder panels and one voltmeter panel. These are carried upon an angle-iron frame standing directly upon the floor. Each generator panel contains two pilot lamps, one dynamo galvanometer, one 1,500-ampere amperemeter, one 600-volt voltmeter, one single-pole circuit-breaker, one dynamo field rheostat, three single-pole, double-throw, 1,500-ampere switches and one single-pole, single-throw switch. Each generator panel also contains one special Don Shea patent field switch, so that generators may be operated either bus-exciting or self-exciting, as desired.

The booster panels contain the two rheostat handles for the booster-field regulators, two amperemeters and the necessary single and double-pole switches for the proper operation of the plant.

On the battery panels of the board the following instruments are mounted: Two 1,200-ampere double-reading amperemeters, four 600-ampere double-reading amperemeters, two 300-volt round-pattern voltmeters, two five-volt round-pattern voltmeters, two 50-point voltmeter switches, four end-cell switch indicators, four sets of motor-contact switches for operating motors on end-cell switches, which are located in the battery room, and the necessary single-pole single-throw switches for making the necessary connections between battery, bus-bar and boosters. There are four end-cell regulating switches located in the battery room, each of 600 amperes' capacity, with points for connecting 50 end cells. Each switch is provided with a motor and gearing which are operated from the battery panel of main switchboard, and the position of the contact switch is shown at all times by the end-cell indicators on switchboard. These switches may be operated by hand, if desired, with the motor completely disconnected. Each motor is capable of handling the two end-cell switches on each side of the circuit, although in practice the two are operated in multiple during times of heavy discharges.

The wattmeter panel is unfinished at present, but is designed to carry when completed four 6,500-ampere, 250-volt wattmeters.

Upon the feeder panels five feeders are connected, each having an amperemeter and double-throw single-pole switch of 1,500-ampere capacity on the positive and negative sides and a double-reading amperemeter and single-throw single-pole switch of 500-ampere capacity on the neutral cable. The voltmeter panel carries one 500-volt voltmeter and two 250-volt voltmeters, each with a suitable switch for connecting to the various pressure wires. All amperemeters and voltmeters except those on the battery panels are edgewise instruments.

There are four bus-bars on the switchboard—one high positive, one low positive, one high negative and one low negative. There are also positive and negative charging buses. The generators are so arranged that each generator may be operated on either high or low bus-bars, either in multiple or separately. For convenience in handling, the right-hand switches are made positive and the upper throw of switches connects to the high bus. Each of the two end-cell switches on each end of the battery may connect either to the high or low bus, or to the charging bus. The two boosters in the plant may each be connected either between high bus and charging bus, low bus and charging bus, or between low bus and high bus, on either side of the system. The boosters may be connected in series either between low-positive bus and neutral or between low negative and neutral. These combinations provide for charging the battery under all conditions of service, and at the same time maintaining it upon the line as an equalizer of the pressure. Also, either side of the battery may be completely disconnected, or the entire battery cut out of service and the balance of the system maintained by means of the two boosters connected together in series and operating between the neutral and either side of the system.

All the electric connections between generator and booster and switchboard are made of asbestos-covered copper cable run underneath the floors and supported upon porcelain holders. The connections between battery and switchboard are made by means of copper bars, lead-covered and painted with an acid-proof paint, and supported upon porcelain racks. The battery is connected through switches to the bus-bars and outside circuits without the intervention of either fuse or circuit-breaker. Two additional generator panels of the same design have lately been added to take care of the additional dynamos contracted for.

Storage Battery.

There are 280 cells (Fig. 9) of the Electric Storage Battery company's accumulators, each containing 13 positive Manchester-type plates and 14 negative chloride plates. These are contained in lead-lined wooden tanks, which are supported on large porcelain insulators resting upon four-by-six-inch beams. The elements themselves in each cell rest upon heavy glass plates, and are separated from each other by glass tubes. The capacity of this battery is 2,000 ampere-hours at a discharge rate of 250 amperes, and it is capable of maintaining a maximum discharge rate of 1,000 amperes for one hour. It is guaranteed to give a discharge of 500

FIG. 9. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS.—STORAGE BATTERY.

kilowatts for one hour without a drop in pressure below 1.7 volts per cell. The normal charging rate is 250 amperes and the maximum charging rate 350 amperes.

The battery, as mentioned above, is located in the basement, partly under the engine room, partly under the sidewalk, in a cool, well-ventilated room. The floor is composed of vitrified tile laid in pitch upon a concrete base.

Conduit System.

The high-tension conduit system consists of three-inch cement-lined pipe, laid on 5¼-inch centers, with one inch of concrete between pipes and three inches surrounding the entire group. All ducts are laid to drain to manholes. The top layer of ducts enters service boxes, which are

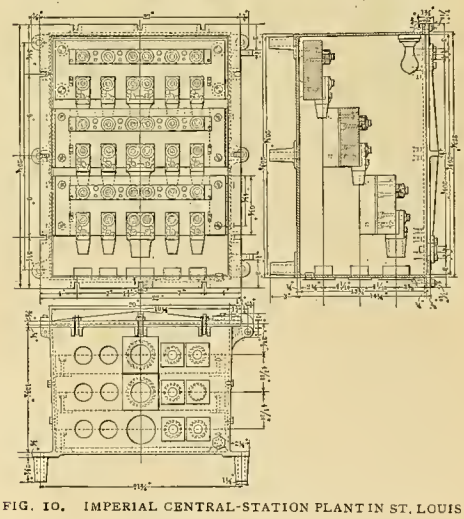


FIG. 10. IMPERIAL CENTRAL-STATION PLANT IN ST. LOUIS —FIVE-WAY JUNCTION BOX.

of two sizes, three by three feet and three by four feet. Service boxes are placed at most convenient points for reaching customers, and their depth is governed by the depth of the conduit at each location. Manholes, located at every street intersection, and oftener, where necessary, are of three sizes, four by four feet, with nine-inch walls; five by five feet, with nine-inch walls, and eight by eight feet, with 13-inch walls. In depth they are all designed to be six feet six inches in the clear under the roof. They are connected to sewers wherever sewers could be reached.

The conduit system contemplates 23 feeding points. The entire distribution system consists of two ducts, providing one duct for a three-conductor cable and one extra duct for city lighting or other service in the future.

[*Continued on page 358.*]

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

510 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new, should be given.

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International telephone extensions in Europe are proceeding apace. Two projects in Switzerland are now under discussion, and if they are carried through, the result will be of primary importance for the European telephone system, as it will unite, by way of Switzerland, the countries which surround that country. The projects in question are those of uniting Tessin with the rest of Switzerland, either by the St. Gothard route or by the valley of the Mesocco. The realization of either of these projects is full of difficulties on account of the mountainous regions passed over by the line, but in view of the importance of the affair, it is expected that it will be shortly taken in hand. The Italian government has already decided to unite Como, which is on the Milan circuit, to Tessin, and this will be one step toward opening communication between Italy and the north of Europe by way of Switzerland. France has now a connection with the latter country by means of the Geneva-Basle line, and Germany is connected through the line from Basle to Schaffhausen. The project now under consideration is thus an important one, as it will provide a connecting link for a number of European lines.

All things considered, the plant of the Imperial Electric Light, Heat and Power company of St. Louis, described at considerable length in this issue, represents the most recent attainments of direct-current power-station design in this country. It is worthy the study of all electrical students, as the contractor gave a specific guarantee of the cost of fuel per kilowatt-hour at the switchboard. While Mr. Humphrey does not state what this figure was, as the tests to compare with it had not been completed when he wrote his paper, it was undoubtedly a low one, for the whole plant gives evidence of an effort to reach the highest efficiency. Mr. Arnold seems to have designed what is really a model station.

In view of existing and prospective telephone competition in large cities the question whether a subscriber has a proprietary right to the use of a certain number to indicate his telephone becomes of some importance. The point has arisen in Memphis, according to newspaper report. Two telephone companies gave a certain coal dealer the number 343, and the man advertised it in all the newspapers in the city and on the walls, until it became familiar to the people. Later one of the companies undertook to give that number to a competitor in the coal business, and an injunction suit has been commenced on the ground that the number has become valuable to the original owner as a part of his business. The opinion prevails that the case will be carried to the Supreme Court of Tennessee for a final decision, and the result will be looked for with no little interest. Of course, there will be no dearth of calling signals in any event, and unless business competitors attempt to obtain the use of certain numbers with the deliberate intention to mislead, the contention seems to be capable of ready adjustment.

Promptly with the reassembling of Congress a Pacific-cable bill was introduced. In his message President McKinley had again called the attention of the senators and representatives to the necessity for such a cable. The bill, which was introduced by Representative Corliss of Michigan, provides for a cable to be laid by the government from the Pacific coast of the United States to Hawaii, Guam and the Philippines. The cost is limited to $8,000,000, and a preliminary appropriation of $500,000 is made to begin the work. The cable is to be laid under the direction of a commission composed of the postmaster-general, the chief signal officer of the army and three other members to be appointed by the president. The rates are to be not more than 35 cents a word from San Francisco to Honolulu, and not more than $1 a word to Manila.

It is to be hoped that this bill or some similar measure may be speedily enacted, so that the country may have the electrical communication across the Pacific which is so urgently needed.

Searchlights were shown to be of great value in naval warfare in the blockade of Santiago in the summer of 1898, and they are now playing some part in the war in South Africa. The correspondents state that by means of beams of light from projectors the British troops at Frere Camp are enabled to communicate with their beleaguered fellow-countrymen in Ladysmith. The distance is not stated, but it is probably about 40 miles. It appears that the Boers are also supplied with searchlights. A correspondent telegraphs from Frere Camp: "As one of our searchlights here is capable of working at 40,000 candle power, the Boers are unable any longer to interfere with the transmission of its signals by throwing rays across its beams." This isn't quite clear, but it seems to indicate that the republican forces had light-projecting apparatus—undoubtedly electric—of sufficient capacity to confuse the signals of the British. If this deduction is correct, the Boers' preparations for field operations were more elaborate and scientific than would have been thought likely. It would be interesting to know more of the apparatus employed on both sides, with the method of operation and the actual efficiency.

The heralds of science in the daily press now announce that the telectroscope, that marvelous invention of Mr. Szczepanik, the Polish schoolmaster, by which one is enabled to "see" an object at a great distance by the electrical transmission of light-wave impulses, is to be shown to the world at the Paris Exposition. It seems that the gentleman with the curious name, tempted by an offer of 6,000,000 francs, entered into a hard-and-fast agreement not to show his far-seer anywhere before the grand display in Paris. Thus, although the invention has been "perfected" for more than a year, the world must wait with as much patience as it can muster until the curtain is rung up at the great exposition. Then the curious visitors, admitted to the hall at the rate of $4 a head, may behold "the moving life of Piccadilly Circus right in London; the arrival of a transatlantic steamer at Brest or Havre, the finish of a Longchamps horse race, and, as curious as anything, a birdseye view of Paris, taken from a balloon actually in the air." How the inventor is to produce this marvel has never been explained with precision, although the newspapers tell of multitudinous points of light projected by vibrating mirrors on a selenium disk, transmitted by electricity and reblended into a perfect image by the use of steel plates and other vibrating mirrors in synchronism with those at the sending end. The description is not so exact that one skilled in the art could reproduce the inventor's apparatus; of course, Mr. S. must protect himself. But at Paris all persons blessed with the price of admission may see what the instrument can do. That is the story, at any rate, and so it will be several months more before it can be definitely determined whether the Polish schoolmaster is a great inventor or an enterprising romancer with a press agent. Is the man an Edison or a Keely?

A real effort is making at St. Luke's Hospital, New York, to determine the value of the theory that medicines may be introduced into the tissues of the body by the use of static electricity. In this case the treatment is administered by Mr. Crotte, and the disease sought to be arrested in this manner is consumption of the lungs. The method is based on the belief that medication can be carried by means of an electric current into the lungs in sufficient quantity and of sufficient strength to kill the tubercular bacilli without injury to the tissue of the lungs. But the hospital authorities discuss the subject with great caution; they hold out no hope to invalids, but are simply investigating the electrical theory. It is worth while to give the very words of the superintendent: "This Francisque Crotte, a Frenchman, was brought to the attention of the hospital authorities, as making great claims for the use of static electricity as a medium for conveying medication into the lungs and killing the tubercular bacilli. The management of St. Luke's Hospital entered into an agreement with M. Crotte to give him facilities for his work, which is to be conducted under the supervision of the medical board of the hospital, who will apply to it strictly scientific tests to prove its value. Such tests have been in progress for some months, and several months more will be required before the medical board can arrive at a definite conclusion as to its value. Realizing the dangers of premature publication, as awakening hopes of those unfortunately afflicted with this disease before the value of the method could be tested, it was clearly stipulated, as a part of the agreement with M. Crotte, that no publication should be made until the medical board was able to speak officially as to its value or lack of value as a cure for consumption. If the public will only be patient and await the results of the scientific tests, the medical board in due time will make its report, which will be given to the public. Of course, the hospital cannot indorse the claims made on behalf of the treatment until the matter has been fully and scientifically tested."

It seems to be well established that by means of electricity the effect of drugs can be set up in portions of the human body traversed by the current. The question is whether there is an antitoxin for the bacillus, and if so, whether it can be introduced in the delicate lung tissue in sufficient quantity without producing serious injury from the projecting agent.

Night Scenes at Niagara Falls.

By Orrin E. Dunlap.

The prettiest piece of electric lighting at Niagara Falls is that on the upper steel-arch bridge close to the falls. This all-metal arch is the greatest bridge of its kind in the world. It is owned by the International Traction company, and on the single deck are laid double tracks for electric-railway service. Both the structure and the offices are supplied with current for lighting from the station in Niagara Falls, Ont. At the Canadian end of the bridge a 15-kilowatt transformer is placed on a platform beneath the flooring. The primary current is 2,200 volts and the secondary current 110 volts. Each side of the structure is on a separate circuit, and every lamp is on a separate branch fuse block. On the bridge there are 60 incandescent lamps of

LIGHTING OF THE UPPER STEEL-ARCH BRIDGE AT NIAGARA FALLS.

50 candle power each, with anchored filaments, made by the Sawyer-Man company. On a structure like this great steel arch, where there is always considerable vibration, the anchoring of the filaments is an important feature. Each lamp is attached to 1½-inch gooseneck, and is protected by a Chapin hood. The goosenecks are firmly fastened by a special attachment to the bridge railing, and they are also lined with flexible conduit. Despite the fact that the bridge, when the wind is from the south and southwest, receives considerable spray from the falls, enclosing globes are not used, as it was found that by coating the base of each lamp with hot asphaltum the plaster-of-paris was prevented from absorbing the moisture. Gent Brothers of Niagara Falls had the contract for wiring the bridge, and at night the great arch presents a beautiful appearance, as indicated, to some extent, by the picture.

The great power station of the Niagara Falls Power company presents a remarkably attractive appearance at night. Especially is this true when the view is obtained from a passing train. When just at the right angle every window on the side of the dynamo room is fully illuminated by the glow from inside. It is, indeed, rather a weird scene, but one that excites many exclamations of admiration and pleasure from those who have seen it. The view given herewith is one showing the dynamo room and the transformer station under full illumination, while the office portion of the front of the building is in darkness.

Importance of Foreign Trade.

In an interview printed in Modern Machinery Mr. P. W. Gates, president of the Gates Iron Works of Chicago, takes an advanced position in urging the extension of American export trade in machinery, advocating the fostering of this branch at the expense of the home market, if necessary. Mr. Gates has but recently returned from a six months' trip devoted to an investigation of the industrial situation in Europe. Exceptional conditions abroad gave the American manufacturer a splendid opportunity to introduce his wares, and he took advantage of the opening and made a favorable impression. With this foothold, every effort should now be made to develop this foreign business as much as possible. A portion of Mr. Gates' interview is quoted:

"There are some disadvantages in manufacturing for the export trade. The conditions abroad are different in many respects from those that obtain in this country. Apparatus that is intended for a certain purpose and is recognized as a standard product in America will not be adopted by the foreign trade. They have their own peculiar ideas about construction and they cling to their old-fashioned methods and their old designs. Many engineers in Europe still believe it to be their mission to provide special designs for each individual installation of machinery. Many things have to be made to order, resulting in increased expense and reduced efficiency. The American engineer believes in standardization. He has confidence in the manufacturer and realizes that companies engaged in the production of certain lines of apparatus have given much more thought and have had much wider experience than he could possibly command, and that the apparatus which they design for work of a particular character is based upon these experiments and this experience. In a word, he is ready to admit that the manufacturer knows his own business and is prepared to produce a machine that is at least as efficient as anything that could be designed by most outside engineers. The only thing, however, that will prevent the constant expansion of our foreign business will be high prices and slow delivery. These two factors will certainly prove important just as soon as the present rush is over. We must understand that while our tools are very much superior, they are being copied very closely. Our prices, as will be remembered, were very low during the hard times, but now there is an upward tendency in every department. We will have to meet competition in the matter of price and delivery, as well as in quality.

"I am not prepared to say how much the advancement in the price of material will influence our foreign trade, but I fear it will prove an important factor, especially if hard times come upon the countries that we are dealing with. I consider this question of the invasion of what have heretofore been considered exclusive European markets by American manufacturers as one of the most interesting problems of our time, and I feel that it will require several years to work out a final and acceptable solution. My advice to the manufacturing interests of this country is that they should do everything they can to continue and increase our foreign trade, even at the expense of the home market. We should give foreign orders the preference in price and delivery. I think this is good business policy, especially in view of the possibility of the flattening out of trade in this country, which is to my mind only a question of time. We cannot hope to continue to enjoy the present prosperity indefinitely. Hard times will certainly result from the present policy of abnormally high prices and artificially stimulated trade. When that time comes we must be prepared to meet it, and our salvation will be in our foreign trade."

Americans Active in Electrical Manufacture in England.

In addition to the large plant of the British Westinghouse Electric and Manufacturing company to be erected at Manchester, England, for the manufacture of electrical apparatus, it is to be noted that another large electrical manufacturing establishment is building in England on American lines and under the superintendence of an American electrical engineer, Professor Sidney H. Short. This latter company is the English Electrical Manufacturing company, and its factory will be at Preston, with a capacity for turning out some 2,000 railway motors and about 50,000 horse power of dynamos per annum. The company has already booked many orders, it is said, including one from France for 800 motors for general distribution throughout the continent of Europe. This is the first occasion on which any foreign order of importance for electric-traction apparatus has been placed with any British manufacturer, and is thought to be significant of the part which the Preston works will undoubtedly play among the great electrical manufacturing concerns of the world. Professor Short is the owner of many electrical patents, of which his company will undoubtedly have the use.

It may be noticed that both the Westinghouse and Short companies appreciate the national sensitiveness and employ the words "British" and "English" in their titles.

There is also a report that the English branch of the General Electric company, the British Thomson-Houston Electric company, is planning to erect near Rugby, England, a $2,500,000 plant, which will be equipped with American machinery.

Space Telegraphy Experiments on the Alps.

The results of the experiments recently conducted by Jean and Louis Lecarnie to determine the practicability of space telegraphy between two points of different altitudes, with the consequent difference in atmospheric pressure, have been presented to the Paris Academy of Sciences. The region chosen was that of the Alps, and the transmission was carried on between Chamounix and Mount Blanc. The transmitting station was established at the sub-station of the observatory of Vallot, at Chamounix, having an altitude of 3,000 feet, the receiving station being installed at another sub-station of the observatory on Mount Blanc; this point is at an altitude of 13,800 feet, thus giving a difference of level of 10,800 feet between the two stations, which were about seven miles apart. The soil between these two points is covered with ice, except at the part immediately surrounding the stations. The experimenters wished to make the following observations: 1. Whether the system of wireless telegraphy was practicable in the high mountain regions, and with great differences of altitude between the stations. 2. If atmospheric electricity would have the effect of interfering with the communications. 3. If the earth wire would continue to fulfill its office, in spite of the absence of water in the liquid state in the soil.

The transmitting station at Chamounix was provided with a high-tension transformer, operated directly by a direct-current dynamo of 50 volts, and in the circuit of which was placed an interrupter of the Reef pattern. A key with platinum contacts sent the impulses at will into the primary of the transformer, which was capable of giving a spark of seven inches. This length of spark was reduced to one inch when the poles of the transformer were connected, one to earth and the other to the overhead wire. This wire was of copper, one-tenth inch in diameter, and stretched obliquely at 30 degrees for a length of 75 feet.

At the receiving station were arranged a coherer of gold filings, constructed by Mr. Branly, and very sensitive, a dry pile of 1.6 volts and a telegraph relay. In the circuit was an electric bell and a magnetic striker for the coherer. Owing to this arrangement a slight shock was sufficient to restore the coherer to normal action, and its performance was very satisfactory during the whole operation. The apparatus is normally sensitive to a spark of 0.04 inch at a distance of 300 feet. The station, being established inside the observatory, was protected from outside disturbances by the copper envelope of the building. The ground connection was made to the lightning rods, and an outside wire was erected parallel to that of the Chamounix station. The two posts were visible one from the other, and thus in good weather optical signals could be sent to verify the results.

GREAT NIAGARA POWER STATION AT NIGHT.

The information obtained by these experiments may be summed up as follows: 1. The signals were very clear under the conditions named, with a distance of oscillator spheres equal to one inch. 2. The absence of water in the liquid state did not prevent communication. 3. The presence of clouds between the stations had no effect upon the signals. 4. The atmospheric electricity could not, on the whole, be said to have had an injurious effect upon the practical transmission of signals. 5. Another point observed was the action of the three-phase, 2,500-volt electric-lighting system at Chamounix, which had a decided effect upon the apparatus, and it was impossible to work while the station was in operation.

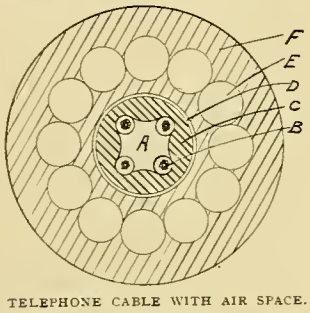
Street-railway mail cars on the cable lines of Chicago are to be replaced by handsome cars on the electric lines, and the change is expected to make a great improvement in the local mail transportation between the main office and the sub-stations. The first change of this kind will be made on the North Side.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Cable with Air Space.

The Telegraph Construction and Maintenance company of London has laid a telephone cable of a new type between Great Britain and Ireland. This cable is for the use of the government and is constructed on the system of Willoughby Smith and Granville. It consists of four conductors, arranged to leave a central air space, in order to reduce the inductive capacity of the lines as much as possible. The exterior insulation is assured by a covering of guttapercha.

Each of the conductors is a cable made up of a large wire in the center surrounded by 10 smaller wires. The diameter of the conductor is about 0.12 inch. The conductor is surrounded and partially covered by a thin coating of guttapercha 0.06 inch thick. Four of these conductors are disposed so as to occupy, in section, the four angles of a square, the distance between the centers of two neighboring wires being about 0.20 inch. The space between the conductors is left free, and the conducting wires are surrounded by an insulating mass of guttapercha, which unites the whole in a cylindrical cable. The insulating mass touches the four conductors on the outer side only, leaving the inner sides free, thus forming an air space in the center which extends about half-way around the surface of each conductor. This air space is divided into sections by joints placed at intervals and formed by filling in solidly



TELEPHONE CABLE WITH AIR SPACE.

with gutta-percha. In this way each of the air spaces is independent of the others.

Around the inner core of the cable, which has a diameter of 0.6 inch, is wrapped a band of sheet brass, then a covering of jute fibers, upon which is an armor of steel wires of 0.28 inch diameter.

Referring to the sketch, showing a partial section of the cable, (A) is the central air space; (B) the conductors; (C), guttapercha; (D), brass sheet and jute; (E), steel armor wires; (F), outer covering.

The electrostatic capacity of the cable, measured between two of the diagonally opposite wires, is 0.1 microfarad per nautical mile. The resistance of a conductor is 8.6 ohms per mile, and the insulation resistance of a conductor from earth equals 1,050 megohms per mile. This construction presents many advantages, both from a mechanical and electrical point of view. A cable of this type may be immersed to a depth of 500 meters without causing deformation. The introduction of air between the conductors has the effect of diminishing considerably the inductive capacity of the cable, and it may thus be used for relatively great distances. The normal insulation is quite sufficient. If, in the case of a fault, the water penetrates into the air chamber, the extent of the damage is limited to one of the sections only. As these sections are not long, the insulation resistance of the cable is not appreciably modified.

The first cable of this type to be laid was that between Beaulieu (Hampshire) and the Isle of Wight, a distance of three miles. A second cable has been recently placed between Ireland and Wales, a distance of 60 miles, the maximum depth of the Irish Sea being 40 fathoms. In these cases the use of the new type of cable has been very successful for telephone work. It is expected that the British government will lay several others of the same construction from England to Holland and to Germany.

Old Company Not Popular in the Twin Cities.

Employes of the Northwestern Telephone Exchange company were recently placed under arrest in Minneapolis for attempting to plant telephone poles in the underground district without securing the consent of the council. The telephone company sent word of its intention to erect the poles and proposes to make a test case.

Members of the council in St. Paul think the company should apply for a renewal of its franchise before asking any further favors of the council in the way of permission to erect poles in underground districts or an entrance to the city for a toll line. The company has asked permission to plant poles on a number of streets, and the Board of Aldermen granted the request. The company has also brought suit against the city for six years' telephone rent, amounting to $3,368. The charter forbids the controller auditing bills not authorized by resolution of the council or by contract. The company has presented bills occasionally, but no attention has been paid to them. Since the council has begun to think of requiring the company to yield to a gross-earnings' tax, the company is inclined to attempt to force the collection of the bill.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A right-of-way is being secured for another telephone line between La Crosse, Wis., and Black River Falls by the Wisconsin Telephone company.

The controversy between the Standard Telephone company and the Home Electric company of Dubuque, Ia., has been settled, and the injunction withdrawn. The telephone company will set its own poles high enough to clear the wires of the Home company. The Standard Telephone company is working to complete toll-line connection between Dubuque and Minnesota points.

A telephone exchange is proposed at Morning Sun, Ia.

The Minnesota Central Telephone company of Willmar, Minn., has issued $20,000 bonds to raise funds for rebuilding and adding additional wires to the line from Delano to Elbow Lake, Minn., and other points.

The Union Prairie Telephone company of Lanesboro, Minn., is making a number of improvements to its line.

The Beloit (Wis.) Telephone company has concluded to enlarge the exchange to 400, to meet the growing list of subscribers. The capital stock has been increased by $5,000.

A local telephone exchange is about completed at Laurens, Ia., with about 30 connections.

The Des Moines (Ia.) Electric Construction company, which has been engaged in the construction of telephone exchanges, will go out of business, it is said.

L. W. Prentice of the Hudson, Wis., telephone exchange, and Miss Florence E. McShane of the exchange of New Richmond, Wis., were married recently at the home of the bride's parents in New Richmond.

The Central Telephone company of Pomeroy, Ia., has increased its capital stock from $10,000 to $25,000.

George A. Wyman of Sheldon, Ia., will become general manager of the Mutual Telephone company of Des Moines. The latter has notified the Edison Electric Light company to remove its wires from the former's poles, claiming the induction impairs the service of the telephones.

The Home Telephone company has the new telephone exchange at Ida Grove, Ia., about completed.

Bell Company Contemplating Great Bond Issue.

[From the Boston correspondent of the Western Electrician.]

Boston, December 7.—Announcement was made to-day that the plan of reorganization of the American Bell Telephone company, by transferring its business and identity to the American Telephone and Telegraph company, includes in its projects a bond issue of huge proportions. An indenture has been executed, it is stated, under which bonds of the absorbing company are to be issued to the amount of $100,000,000, the interest thereon to be at the rate of five per cent. The Old Colony Trust company of this city is named as the probable registrar.

The scheme to float such a large bond issue is regarded as indicative of the Bell company's intention to continue its policy of absorption and of controlling as far as possible the telephone business of the country. It is small wonder that the company contemplates removal from Massachusetts, for it is perfectly safe to assume that the Legislature, which has balked so often at expansion measures brought forward by the telephone company in the past, would have refused utterly to sanction pending propositions. The company is well aware of this fact and will act accordingly.

As a matter of fact, at the present time, the capital invested in the Bell company and its allied corporations is $200,000,000 or more. About $10,000,000 is in real estate, owned by the subordinate companies in various business centers. Until quite recently this great system has been carried out by sales of capital stock of the various sub-companies and by fresh issues of American Bell Telephone company's stock to enable the parent concern to take up and pay for a certain proportionate share of the stock of such companies when they were added to the system. Bonds, however, have been floated to the amount of $5,049,000 within a few years, an item to that effect figuring in the annual report, and future expansion will probably be along the same line. B.

Telephone Patent Litigation.

The case of the Western Electric company against the Williams-Abbott Electric company on the Elisha Gray patent (No. 309,617) relating to the automatic opening of a shunt about a telephone generator is set for argument at Cleveland, O., on December 13th, before Judge Taft or Judge Day.

The suit of the Western Electric company against the Citizens' Telephone company of Grand Rapids, Mich., is set for argument on December 19th, before Judge Severens. The case involves the first and second claims of the Eldred patent (No. 303,714) on switchboards.

Telephone Situation in New York.

[From the New York Tribune.]

The purchases of the Telephone, Telegraph and Cable company of America in Westchester County include the new plant now in operation in New Rochelle and the franchises owned by the same company in Mamaroneck and White Plains. A controlling interest in these plants was acquired through the purchase of the stock held by the president, George W. Sutton. The New Rochelle plant has been in successful operation about six months and has nearly 300 subscribers. A controlling interest has also been secured in the Palisade Telephone company, a concern which owns a franchise in Yonkers.

The only local company not yet in its control is the Mount Vernon Telephone and Messenger company, which has been operating in Mount Vernon about five years and has 300 local subscribers. This company defaulted the interest on its bonds and has been foreclosed in the interest of the bondholders in Mount Vernon. It was bid in by William Archer, the New York builder, who is both a stockholder and a bondholder, for $25,200. It was rumored after the sale that the company would be sold to the Telephone, Telegraph and Cable company of America, but this could not be verified.

Representatives of that corporation were at the sale, but declined to talk. The company will begin at once to build in Westchester County, and expects to have all of its plants in operation in a year. The New York Telephone company now charges 20 cents for tolls between cities and villages in Westchester County and 35 cents to New York. The new company expects to offer the same service at greatly reduced prices.

The Knickerbocker Telephone company has taken from the Astor estate a 20-year lease of the seven-story building at the northwest corner of Broome and Elm streets, and the property will be occupied by the People's Telephone corporation for its exchange.

The Bell Telephone company, it was said recently, in buying out the Independent telephone companies in Newark and Jersey City, had the purpose of strengthening its hold on the New York terminals of the long-distance service in the direction of Philadelphia and the West, but it felt that its control of the local telephone field was secure, through its practical control of the subways. The People's Telephone corporation, however, having, after many years of fruitless application, secured recently from the city authorities the permit necessary to enable it to proceed with the work of stringing wires and installing a telephone plant, joined forces with the Telephone, Telegraph and Cable company of America, among the leading interests in which are certain men prominent in the control of the Metropolitan Street Railway company, and an arrangement was reached whereby the necessity of applying for space in the city's subways was avoided—an application which it was believed would be denied on the ground that the required accommodation did not exist in those subways—and the unoccupied conduits of the Metropolitan's system, north and south and crosstown, were placed at the disposal of the People's Telephone corporation, and many miles of telephone cables were strung in them during the 24 hours of last Sunday [December 3d]. Moreover, it is reported, cables which may be utilized for telephone service were during the same period strung under the elevated-railroad structures in this borough and Brooklyn.

[Mr. Vreeland denies flatly the statement that telephone lines have been laid in Metropolitan conduits.]

It was reported that the People's Telephone corporation had purchased the franchise of the General Carriage company—an unusually liberal one—and, in case of litigation by the Bell Telephone company based on the allegation that it could not under the law operate a telephone service with wires strung elsewhere than in the subways already occupied by the Bell company's wires, would operate such service under the rights and privileges of the General Carriage company, which are said to be amply sufficient to justify the People's Telephone corporation in placing its wires in the Metropolitan's conduits, and even to enable it to occupy and tear up streets in any part of the city.

Telephone Tariff at Paris Exposition.

The new regulations for the telephone service of the Paris Exposition have recently appeared. Among them the following are the most important:

Article I.—The annual subscription for the main system of Paris is fixed at 300 francs for the telephones to be established witbin the limits of the exposition. These subscriptions do not include the free delivery of a card of admission to the public telephone cabinets established in the different parts of the city. Subscriptions last from December 1, 1899, to December 20, 1900.

Article II.—Cards of admission have been provided for the public telephone cabinets which will be installed in the interior of the exposition, and will give the right to communicate, free of extra charge, with all the subscribers of the telephone system of the city, as well as the right to use the public telephone cabinets outside of the exposition. The tariff established for these cards, which last one year, is fixed uniformly at 20 francs.

The Acute Ear of the Telephone Girl.

There is a man in Chicago who relates a curious experience. Some time ago he had occasion to talk to a business acquaintance over the telephone. He called up the central office and asked for his friend's number. In a moment there came back to his ear in a soft feminine voice the familiar murmur, "Line's busy now; please call again." The man at the telephone was really anxious to communicate to his friend, who was a valued customer, without loss of time. Accordingly, he called up the operator again in two or three minutes, with the same unsatisfactory result. This procedure was repeated several times, the girl invariably protesting in calm, even tones that the desired connection could not be obtained. From growing irritation the impatient man at the instrument passed to a complete, though momentary, loss of his temper, and he soundly berated the girl at the switchboard for what he thought was simply careless inattention to her duties. The girl returned a soft answer in a few words, and thus the brief dialogue terminated.

This was a very ordinary incident, but the sequel, as told by the narrator of the story, was surprising. "About a week after my colloquy with the telephone girl," he said, in continuing his veracious relation, "I had occasion to take an elevated-railway train and stopped for a half minute to exchange a word with the ticket seller, with whom I have a slight acquaintance. It was only a word, however, for there was a young woman behind me awaiting her turn to pass through, and so I hurried out to the platform and into the train. The girl behind me entered the same car and took a seat across the aisle from me. I noticed that she was preoossessing in appearance and neatly dressed, but as I have a grown-up family of my own and have passed the age of youthful follies, my glance toward her was merely one of casual benevolence. A moment later, however, I was conscious that she was regarding me intently. She was evidently reassured by my mature and unassuming exterior, for, to my astonishment, she quickly arose and took the vacant seat beside me. Before I could imagine what was up, she began to speak. 'Please pardon me for my presumption,' she said; 'but are you not the gentleman who had some difficulty in getting Harrison Ninety-nine-double-nine on the telephone last week?' I was completely mystified, but I remembered the number very well, and I said I was the man. 'Well,' said she, 'I was the girl at the central office. I remember you by your voice.' You may imagine my surprise. Of course, I was profuse in apologies when I recovered myself a bit. The young woman, evidently regarding me as a trustworthy, fatherly sort of a person, then proceeded to tell me a great many things I had not known about the arduous duties, strict discipline and perplexities of a telephone girl. She spoke with dignity and self-possession, and her earnest, lady-like manner made me doubly ashamed of my trivial impatience. But before I could again express my regret the train had reached her station and she was gone. I am still wondering, however, at her wonderful ear-memory. She had heard my voice but for an instant at the ticket seller's window, and yet she remembered it from among the thousands of others that come to her over the wire."

GENERAL TELEPHONE NEWS.

A telephone company has been organized at Waterville, Me., with Boston capitalists prominent among the incorporators. The capital is named at $300,000, and Henry M. Whitney of Brookline is president and A. J. Mundy of Boston treasurer. Other incorporators are Elisha Gray of Boston, C. W. Davis of Waterville and J. B. Millet of Boston.

The Fairbury Telephone company of Fairbury, Neb., is having a lively time with the Bell company. The Independent company has 125 subscribers, at $1.50 and $1.25 a month. The Bell company has 75 and has cut to 50 cents a month, but as the Independent company has about 50 local business men as stockholders, it seems to be on the winning side.

The Waterbury (Conn.) Automatic Telephone company has been incorporated. The capital stock is $10,000. The purpose of the company is to build, equip and maintain systems of telephone exchange in the cities, towns and villages of the state. The corporation is located in Waterbury, where all but two of the stockholders live. The certificate states that 50 per cent. of the capital stock has been paid in. It is signed by Warren L. Hall, John Blair, William S. Jones and W. D. Richardson of Waterbury, a majority of the directors.

MANUFACTURERS AND DEALERS.

In the Patent Gazette of December 5th there was listed a patent (No. 638,521) granted to Seymour Morrison and Thomas L. Springer for a telephone switchboard. The principal feature of the invention is a self-contained operator's cam and drop, removable from the board. This device, which is said to be the only self-contained removable cam, operating in the way it does, now upon the market, is to be known as the Eureka self-contained removable cam and drop, the Eureka Electric company of Chicago having, it is reported, secured control and ownership of the patent. The Eureka company has recently issued a large sheet containing a number of illustrations of the telephones, switchboards and telephone apparatus manufactured by the company.

Paris-Berlin Telephone Line.

The project for a telephone line from Paris to Berlin has occupied for some time past the attention of persons interested. The necessity of telephone communication between the two capitals has long been recognized, but owing to the rather strained relations between the two countries, the negotiations for a project of this kind have been difficult to carry out. The matter has, however, been taken in hand by the two governments, and has been recently brought to a successful conclusion. M. Mougeot, secretary of the Postal and Telegraph service for the French government, recently sent two delegates to Berlin, where a conference was held with the representative of the German Postal Department. As a result of this discussion, the French delegates reported favorably to their government and the treaty was accordingly signed.

The agreement is somewhat on the same lines as that established between the French government and those of Belgium and Switzerland, these latter agreements having been made the basis for the Paris-Berlin operations. A number of important financial companies and chambers of commerce in France gave their support and assisted in bringing matters to a successful conclusion. The amount necessary for the construction of the line on the French side will reach 750,000 francs. The French government will take charge of the construction and bear the expenses of the line from Paris to the frontier, from which point the German government will complete the line, this, however, without the aid of outside capital, as in France, as the government is able to install its part of the line independent of the assistance of the financiers.

The total length of the line will be about 660 miles. Starting from Paris, it will pass through Chalons, Verdun, Metz, Frankfort to Berlin. The system of charges for the use of the line is established in what is known as the "zone system." The two countries have been divided each into two zones, and the amount to be paid to each for a conversation of three minutes will be two francs for the first zone and four for the second. Thus, for a conversation between Paris, which is in the first zone on the French side, and Berlin, in the second on the German, each country is to receive six francs.

An arrangement has been made for urgent communications by which they will pass before the others; for this a triple rate will be charged. For the cities and towns near the frontier a much lower rate will be made, this being not more than 25 to 50 cents for a conversation of three minutes.

The construction of this first line between France and Germany will soon be followed by others; the first of these will be a line between Belfort and Mulhouse, these cities being situated on either side of the Alsatian frontier. These two important industrial centers have for some time felt the need of this communication. The work on these new lines will be carried forward rapidly and it is expected that they will be completed in the early part of next year.

Lively Prospect in Cleveland.

If the $10,000,000 bond issue of the Erie telephone system is approved by the stockholders, it is said that $2,000,000 of the proceeds will be expended in Cleveland, Ohio, and vicinity during the years 1900 and 1901.

A mortgage for $3,500,000 by the Cuyahoga Telephone company of Cleveland, to the Dime Savings and Banking company, was placed on file last month. At the same time the mortgage was filed a deed was filed by the Terminal Electric company, by which the new Electric building on Prospect street was transferred to the Cuyahoga Telephone company. The consideration named in the deed was $1, but it contains $75 worth of revenue stamps, which would indicate that the value placed on the new structure is $75,000.

The mortgage given by the Cuyahoga Telephone company is on its franchises and other property, real and personal, including the new building just purchased. The mortgage is payable in 20 years and draws five per cent. interest. The money is to be used by the company for extending and completing its system.

Why Not American Telephones in Mexico?

Two Republics, a City of Mexico newspaper, states that the hacendados resident in Toluca who own estates around Malinalco and Tenancingo have contracted with Mr. Fernando Corona, the Mexican electrical engineer, to put up telephones in their haciendas, connecting them all with one another. It seems that Mr. Corona is using German instruments, and not American. Where are the American agents? naturally asks the newspaper named.

Illinois Telephone Association.

A called meeting of the Independent Telephone association of the state of Illinois will be held at Decatur on February 7th and 8th. It is desired that all persons interested in Independent telephone work in this state arrange to attend this meeting, as matters of especial interest will be discussed.

The Iowa Automatic Fire Alarm company has been incorporated at Newton, Ia., with $50,000 capital stock, to manufacture automatic fire alarms.

Good Telephone System Needed in Manila.

A writer in one of the American papers published in Manila says that of all the aggravations which the sojourners in Manila are called upon to put up with, the telephone service is about the worst.

If the red-hot complaints which are fired into "central" every day do not burn the very soul of the company to a crisp it is because it is a soulless corporation. The telephones now in use are the greatest incentives to profanity yet discovered. A busy man grabs the antiquated instrument to deliver in haste some important message—he presses the button and then takes a rest. After an indefinite time maybe the attention of "central" is attracted and he receives an answering ring. Then he asks for number so-and-so. Of course, he does not get it, so he repeats the request. An indistinct mumbling comes over the wire and possibly he catches an occasional Spanish word. Again he makes it known that he wants number so-and-so. No response. In his gentle accents he coaxes "central" to give him the desired number. But the soft persuasion is lost somewhere on the rusty wire. He is angry now, and in stentorian tones he demands that number instantly. But the employes at the telephone office are not to be intimidated. "You won't give me the number, eh?" he shouts, yet the transmitter brings him no reply. From this point on until 15 minutes later, when he has sworn himself hoarse, the remarks made anent the telephone, the company and all thereunto appertaining are quite unfit to appear in print. And, after all, the sending of the message is either postponed or else some more reliable means of communication is adopted.

The telephone company has promised to reform its system and to improve its system—who knows? Wonders may happen, but it is probable that the people of Manila will continue to be irritated in the same old style with inoperative telephones until the city is supplied with the inventions of Bell and Edison in accordance with American ideas.

The present company claims to have a monopoly, but it is extremely doubtful if it could shut out a rival that was up-to-date, either under Spanish or American law. It is "contrary to public policy to establish monopolies that restrict trade," and they are therefore illegal. Besides, as one citizen suggests, the system now in vogue could be condemned as a nuisance and as such be abated.

Sale of the South Bend Company.

Commenting on the sale of the Independent telephone plant in South Bend, Ind., to the Central Union (Bell) company, the Elkhart (Ind.) Daily Truth remarks that the transfer is a disastrous thing for the telephone users of South Bend. It says: "Before the South Bend Independent system sold out to the Central Union the rates of both companies were $15 a year for residence telephones and $30 a year for business houses. These rates are considerably in excess of those charged by either of the competing lines in this city, but South Benders considered them moderate. Since the consolidation the rates in South Bend have been advanced to $30 for residences and $48 for stores and business places. These figures have not yet been made public in that city, but Truth has received them from a reliable source, and it will be but a few days before the company notifies its patrons of the advance in rates. Twice within the past three years has the Central Union company made an offer to buy the Independent line in this city, but the management of the Home company would sell only on condition that no increase should ever be made in present rates, and to this condition the Bell company would not agree. In this transaction the Independent company acted honorably with its patrons, and its course is to be highly commended."

Carty Bridging-bell Patent Litigation.

The case of the Western Electric company against the Anthracite Telephone company of Hazleton, Pa., for alleged infringement of the Carty bridging-bell patent, was argued on motion for preliminary injunction before Judge Acheson in Pittsburg on November 28th and 29th. F. P. Fish and George P. Barton presented the case for the complainant, and R. S. Taylor, C. C. Bulkley and Arthur Steuart represented the defense. A large number of additional affidavits were filed for the defense during the two days of the hearing, and the complainant was given three weeks within which to reply by counter affidavits. It is understood that Judge Taylor represented the Independent telephone companies generally, and Mr. Bulkley and Mr. Steuart the American Electric Telephone company of Chicago and the Viaduct Manufacturing company of Baltimore respectively, from which companies the Anthracite company purchased its apparatus. This case, it is thought, has become the test case as to this particular form of magneto apparatus manufactured by the American and Viaduct companies. The defense was given leave to file a brief and the complainant an opportunity to reply. An early decision is expected.

On a petition filed in the name of the states attorney of Illinois an injunction has been issued temporarily restraining the construction of a street railway in the village of Lemont, Ill., by the Chicago and Joliet Rapid Transit company.

Imperial Central-station Plant in St. Louis.

[*Continued from page 353.*]

Where feeders were located the number of ducts was increased to provide for them. The system as planned provides for feeders of sufficient size so that one of the largest cables would fill one duct, taking a single cable for the positive and another for the negative sides of the system. A third duct would contain the neutral feeder and pressure wires. Another duct is to contain the three-conductor main cable, and one duct is reserved for future service.

Underground-cable System.

While the conduit system provides space for a total of 23 feeders, there have been but five installed at present. Each feeder consists of two 1,500,000 circular-mil single-conductor cables and one 500,000 circular-mil single-conductor cable for the neutral wire. A pressure wire of No. 16 three-conductor cable carried in the same duct with the neutral, and connected to the ends of the feeder, provides means for measuring the pressure at the feeding point by a voltmeter located at the plant. The neutral conductor is only one-third the size of each of the other wires, since the entire motor business supplied by the company is connected directly to the positive and negative wires, and does not affect the load upon the neutral. It will also be observed that the feeder cables have all the same carrying capacity, notwithstanding the fact that some are nearly twice the length of others. The object of this is to economize conduit space and cost of cables by using the largest cable that can be conveniently pulled through a duct. Provision is made at the plant for keeping the pressure at the ends of all these feeders approximately equal, regardless of their length and the variation in drop, by running different voltages at the switchboard.

Each of these feeder cables connects to a single-pole double-throw switch on the switchboard without the introduction of any fuses or circuit-breakers. Each feeder goes through two feeder-testing boxes placed at convenient distances along its length, and at the end connects to the system of mains through copper fuses located in the junction boxes.

The mains are composed of three conductors, each of the same size, to provide for better distribution of pressure. The rubber tape surrounding each conductor was made of a distinguishing color for convenience in connecting, and very few errors of this kind were made in connecting together the entire system. The junction boxes are shown in detail in Fig. 10. Into them these three-conductor mains were run and connected to bus-bars through copper fuses.

The feeder testing boxes referred to above are similar in design to the junction boxes as shown in Fig. 10, although somewhat smaller and not so deep. They provide convenient means for opening the feeders for testing, the location of trouble or the making of repairs. Connection is made in these boxes by heavy copper links, which are not in any case intended to act as fuses.

The insulation resistances were all measured by means of the capillary electrometer designed by H. C. Burgess of the University of Wisconsin and described by him at the Omaha meeting of the American Institute of Electrical Engineers. The results were found to be highly satisfactory.

Inside Wiring.

The entire inside wiring is done on the two-wire multiple-arc plan. The lateral cables entering the basements of the customers' buildings, are three-conductor cables, furnishing a constant-potential supply of electricity at either 235 or 470 volts. All electric-power service is connected to 470 volts, and the inside wiring is run open and supported on porcelain knobs, with rubber-covered wire. The incandescent and arc-lamp wiring is taken off one or the other side of the system at 235 volts, and run with rubber-covered wire, either on porcelain knobs or cleats or concealed in an approved conduit system.

Incandescent Lamps.

The incandescent lamps used on this system are of the 235-volt type, mostly of 16 candle power, although some 10 candle power and some 32 candle power are in use. The lamps are all Westinghouse cap and porcelain base. The filaments are either double, two in series, or coiled in several convolutions.

The lamps were bought under guarantees regarding efficiency, life and the maintenance of candle power, which were entirely satisfactory to the purchaser. In practical operation the light has been entirely satisfactory to customers, and they compliment the character of incandescent service furnished. There were at first minor mechanical and electrical defects, however, such as the sagging of the filament until it touches the glass where lamps are not placed in a vertical position, and the short-circuiting of leading-in wires when a filament burns out near its support, all of which have been remedied in later lamps. There have, however, been no accidents or fires resulting from these causes.

Arc Lamps.

It was believed at the time that the plant was designed that arc lighting might be made secondary to both the incandescent and motor work. The 235-volt enclosed-arc lamp was therefore adopted on account of its convenience, one light being controlled independent of all others. It has been found by experience that two arc lamps burning in series on 235 volts give better service than the single lamp. In cases where a single lamp must be used a satisfactory light has been obtained by increasing the current to 3½ amperes.

Motor Service.

The entire power service is taken from the outside wires of the system at 470 volts. These wires inside of the building in all cases are treated as high-tension circuits. It might be surmised that complaint would be made regarding the power service on account of this reduction of voltage on 500-volt motors. This has not proved to be the case. The motors having been previously used upon systems varying in voltage from 450 to 550, the users of power were educated to expect a considerable variation in the speed of their motors. With a steady pressure of 470 volts at the motor terminals, none of the company's customers have complained regarding their power service.

Load Curve.

It may be interesting to submit a preliminary load curve of this plant, prepared by the engineers and submitted to the company two years and a half ago, and to compare it with an average load curve of the plant at present. We have reduced the scale of the former and plotted them side by side on the same sheet. These curves are shown in Fig. 1. Their correspondence in shape is interesting. Their points of difference are explained by the increase in the arc business above referred to. This curve also shows one of the great advantages of the storage battery. The entire plant is shut down from one o'clock until five in the morning and the load carried upon the battery. The machinery is then started and the battery charged during the forenoon, allowed to float upon the system during the afternoon and discharged during the peak in the evening, as shown upon the shaded portion of the curve; and again charged considerably during the first half of the night before shutting down. Interesting features are the large all-night load and the comparatively low peak or maximum load. The average output for 24 hours is 2,198 amperes, which is 39.27 per cent. of the maximum load.

Special Features.

The distinguishing features of this plant which marked it as advanced engineering practice are:

First—The 220-440-volt system of distribution.

Second—The entire system is underground.

Third—The battery equalizer and auxiliary.

Fourth—All subsidiary apparatus is electrically driven.

Fifth—Fuel economizers with induced mechanical draft.

Sixth—Condensing apparatus with cooling tower.

(a) The wisdom of selecting the double-voltage system will be appreciated when it is stated that the saving in copper alone in the district covered by this plant is equal to half the cost of the building and entire station equipment. This system was almost unknown at the time of its adoption here, but several plants using it have since then begun operation in Europe, and another large installation is being erected in this country. The system is reliable, safe and satisfactory in its service to the public.

(b) The undergrounding of all wires is the ideal method of distribution, as regards public safety, reliability of service and low depreciation and repairs.

(c) The value of a storage battery as an equalizer of pressure and as an auxiliary to the steam plant is universally admitted. It has proved indispensable on many occasions in this plant. Its readiness to take all burdens thrown upon it, whether accident to plant, short-circuit in underground cables or sudden demand for light caused by a thunderstorm, needs only to be experienced to be appreciated.

(d) Driving all boiler-feed, circulating and air pumps, elevator, fans, etc., by electric motors saves the condensation in all subsidiary steam pipes, as well as avoids the wasteful use of steam incident to this class of apparatus. By using steam only in the large cylinders of the compound condensing engines and driving all minor apparatus by motors, it is estimated that a saving of about 10 per cent. on the entire output of the plant is realized.

(e) Fuel economizers give all the water entering the boilers an additional temperature of 100° Fahrenheit, which effects a saving of about nine per cent. in the use of fuel. With coal at $1.50 per ton, they will earn annually about 25 per cent. on their cost.

(f) With all losses deducted, it appears that condensing apparatus as here employed makes a saving of from 15 to 20 per cent. in fuel, thus earning a large return on its cost.

The entire station equipment was included in one contract, under rigid guarantees from the contractor covering the efficiency of the plant as a whole. A definite cost of coal per kilowatt-hour delivered to outside circuits from the switchboard was guaranteed under a forfeiture in case of failure, with an equal bonus for increased efficiency above the figure specified. It was intended to give in this paper the results of these tests, but, as they are not completed, no report can as yet be made.

[To Mr. Humphrey's paper may be added the statement that the Arnold Electric Power Station company of Chicago was the contractor for the entire station equipment of this interesting plant. The Arnold system of connecting engines and generators, with magnetic clutches, is used.]

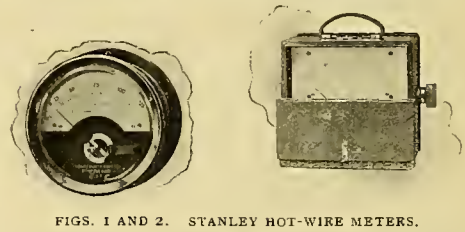
Stanley Hot-wire Meters and Lighting Transformers.

Electrical indicating or measuring instruments, operated by the expansion of a length of wire due to the passage of the current, have been in use as laboratory instruments for many years; but, though very accurate when properly used, they have not been employed in regular commercial work, because, made for laboratory purposes only, they have been of delicate and extremely sensitive construction, and therefore not substantial enough for general use. A modified form of this type of instrument has been perfected after years of study and experiment by Hartman & Braun, Frankfort-on-Main, Germany, the celebrated manufacturers of electrical instruments. The Stanley Electric Manufacturing company has secured the sole right to manufacture these instruments in the United States under the Hartman & Braun patents, and is now prepared to furnish amperemeters and voltmeters of any range desired, both of the switchboard type and in a portable form.

In these instruments faults of the earlier forms have been eliminated, and they are now said to be equal in accuracy and durability to any type of instrument manufactured. Both the ammeters and voltmeters are entirely non-inductive, and the same instrument, when standardized for use on direct currents, is also accurate for alternating currents, and is not affected by frequency or forms of the wave. They are not disturbed or affected by extraneous magnetism or currents, or by changes of temperature in the surrounding air. They can be kept in calibration by bringing the pointer to zero when no current is passing, an easily accessible screw being provided for this purpose. The switchboard instruments are said to be accurate to within one-half of one per cent., and the portable type to within one-fourth of one per cent., throughout their useful range.

These meters are said to be absolutely dead-beat, and are therefore desirable for direct-current railway work, for use in connection with synchronous motors and all other classes of work where the current or electromotive force is subject to frequent or constant fluctuations.

In the hot-wire ammeters only a small portion of the total current measured passes through the instrument, the main portion passing through a



FIGS. 1 AND 2. STANLEY HOT-WIRE METERS.

shunt of low resistance. For the switchboard type of ammeter (illustrated in Fig. 1) this shunt is external, and can be placed at any convenient point, the wires running from the shunt to the instrument being comparatively small. By providing several shunts the same instrument can be used for widely differing currents. In such cases the meters can be marked with several scales, or, where the relative resistance of the different shunts is in a direct ratio, the proper scale can be provided for one shunt and the readings multiplied or divided when other shunts are used. In the portable type of amperemeter this is of great convenience, as two or more shunts may be carried in a separate box, so that an instrument may be used for a variety of maximum readings, such as five-50-500 amperes. A low-reading instrument of this type is of special value in storage-battery work. The portable ammeter is mounted in a well-finished polished-oak box, with lock and key, and is very light, so it is not difficult to carry. This type is illustrated in Fig. 2, which shows the box open. Switchboard amperemeters, provided with external shunts, are carried in stock by the Western Electric company of Chicago, the western agent for the Stanley company, in capacities ranging from five to 5,000 amperes, and the portable instruments, provided with a single shunt in the same box, range from five to 200 amperes.

The switchboard voltmeters present the same general external appearance as amperemeters. A resistance is furnished with each instrument, which, in voltmeters reading up to and including 300 volts, is placed inside the case; for higher voltages an external resistance is used. By providing several separate resistances the same voltmeter can be used for reading several different maximum voltages, and in the portable type this is of great advantage, as two or more resistances can be carried in a separate box, and when so equipped the pressure of direct or alternating circuits of any desired voltage can be readily measured. These instruments, both for switchboard and portable use, are carried in stock in sizes ranging from five to 600 volts.

Some eight years ago the Stanley company introduced what it asserts was the first high-grade transformer made. Since that time it has steadily advanced in the art of transformer building, and is now able to offer the trade a complete line of lighting transformers which the company feels assured are the best made. In the Stanley type G transformer the company has aimed to maintain a reg-

ulation so close that it is not inimical to the life of the lamps, and at the same time, by the use of specially prepared iron and scientific arrangement of the coils and iron, reduce the core loss to a minimum. Moreover, it has desired to make the regulation the same on all sizes, to facilitate the maintaining of an even distribution of electromotive force on all installations and to facilitate the running of transformers in multiple, as where two or more transformers of different regulation are operated in parallel the one having the best regulation will tend to take more than its share of the load. Under the varying conditions existing in different stations this best medium point will, of course, vary, and where the standard transformer is not just what is wanted the company will make transformers of any desired regulation or any desired core loss, within possible limits, and guarantee the results. In maximum efficiency, and particularly in efficiency at lower loads, the type G transformers are said to maintain a high standard of excellency. They are primarily designed for operation upon circuits of 60 periods a second. The manufacturer guarantees that the core loss of the transformers will not, during their lifetime, increase more than five per cent., provided they are operated under normal

Fig. 3.

Fig. 4.

Fig. 5.

STANLEY TRANSFORMERS.

conditions of load and temperature. These transformers are designed for use without oil, and are tested with a break-down strain of 5,000 volts alternating current between the coils and iron. The coils are moisture-proof, the insulating material being of such a nature, it is said, that its insulating properties increase with age under normal conditions of operation.

The Western Electric company carries in stock 14 different sizes of standard lighting transformers, ranging in capacity from 500 watts for 10 lights to 30,000 watts for 600 lights. All the transformers are provided with interchangeable primaries, so that they can be connected for either 1,000 or 2,000 volts.

Smaller types are provided with interchangeable secondaries, so that they can be connected for either 50 or 100 volts, or for use on a three-wire system with 50 volts between the middle wire and either of the outside wires, while the larger sizes have interchangeable secondaries for connection on either 100 or 200-volt circuits or for use on a three-wire system with 100 volts between the middle and either of the outside wires.

All the transformers mentioned are of the outdoor type, and are provided with hanger irons, the tops of which form hooks of a proper size to fit over standard cross-arms. The larger types are also provided with feet, so that they can be set on a floor or platform, if desired.

Fig. 3 shows the type of the smaller transformer with fuse boxes, while Fig. 4 illustrates the larger sizes, without fuse boxes. Fig. 5 represents in detail the cut-out or fuse box used on type G transformers. These fuse boxes are detachable and can be used either on the transformers or attached to cross-arms, poles or buildings, as desired, and are single-pole porcelain cut-outs enclosed in an iron box.

American and English Electrical Engineers May Meet at Paris.

At the meeting of the British Institution of Electrical Engineers last month, the president, Professor S. P. Thompson, made several interesting announcements. He said that the Council had decided to hold a meeting of members of the Institution in Paris on August 16, 1900. At the Paris exhibition there would be certain congresses held, and among these there was a congress of electricians, which would be held from August 18th to 20th. The Council had arranged the Institution meeting for the 16th in order to have time for discussion before the congress meeting. There were certain propositions regarding the electrical units which would probably be made, and it would be as well for the members of the Institution to draw their own conclusions first. It was also proposed to hold one meeting in common with the American Institute of Electrical Engineers. Mr. Kennelly, the president of that body, had written, asking if such a meeting could be arranged, and the Council of the British Institution had answered that it would be most happy to do everything in its power to bring the joint meeting about.

Great Explosion Promised.

Mr. R. M. Jones, well known in connection with power-transmission plants in the West, and now engineer of the Pike's Peak Power company, has issued, on behalf of the company, a unique invitation to a dam-blasting party. "You are cordially invited," he writes from Victor, Colo., "to be present at (a probable safe distance of about a mile from) 'Dam Site' on West Beaver Creek, Teller County, Colorado, at 2 o'clock p. m., on Monday, December 18, 1899, to participate in an explosion of 'Vesuvius Butte.' Kindly bring your kinetoscope and accident policy."

Further particulars of this interesting event show that "the explosion to take place is expected to be of value to the company, by breaking 40,000 cubic yards of granite and removing it from its present picturesque position in place to a disorganized mass of boulders, filling a place of usefulness in the construction of a steel-faced, granite-filled dam across the cañon. It will be particularly interesting to those glorying in the science of engineering (demonstrating the quantity of explosives required to move given bodies). It will probably be exciting and interesting to those who like fun. There will be 30,000 pounds of explosives lighted at the same instant, and it will be ignited, probably, by the same means employed in blowing up the Maine. This will be the largest premeditated explosion on record in the United States, excepting that at Hell Gate. Accurate surveys of the butte have been made and photographs taken. Photographs will be taken at time of explosion and after the surface has been cleared away. Surveys and photographs will show the practical results attained."

All who are interested in power development will hope that Mr. Jones' explosion will be a complete success, both as an engineering work and as a spectacle.

CORRESPONDENCE.

New York Notes.

New York, December 9.—The National Street Railway Construction company of New York, it is definitely announced, will bid for the contract for the underground rapid-transit railway. This company was incorporated shortly after the appointment of the Rapid Transit Commission, and is especially empowered to construct tunnels for the operation of railways. It is capitalized at only $5,000, but has the privilege of increasing its capital at any time desired. Engineers have been employed by the company in making estimates of the cost of constructing the tunnels and the probable number of passengers that can be carried by the railroad, together with the cost of equipment and maintenance of the road. Prominent in the company is H. M. Littell, of the banking house of J. W. Seligman & Co., formerly general manager of the Metropolitan Street Railway company of this city and ex-president of the American Street Railway association. Connected with Mr. Littell in the management of the company's affairs are said to be F. W. Abbot, civil engineer; Louis Duncan, electrical engineer, and James P. McQuaide, of the National Conduit and Cable company. It is understood that they will have the financial aid of several wealthy men if the company gets the contract for the tunnel road. It is estimated that 100,000 passengers a day will be carried over the road as soon as the first section of the tunnel is used, and that the number of passengers will be increased to 1,000,000 a day before the end of the 50-year lease. The operating expenses of the road, it is estimated, will be about 50 per cent. of the gross receipts.

Rumors have been afloat in Wall street this week to the effect that negotiations were practically completed for the consolidation of the Electric Vehicle company, the International Air Power company (Mr. Croker's autotruck company), the General Carriage company and various cab and carriage companies now operating in the larger cities of the United States into one gigantic corporation, which would be controlled by William C. Whitney; and a director of the General Carriage company was quoted as saying that that concern would have between 300 and 400 cabs and carriages in service in this city before January 1st, although it had not yet placed any orders for either vehicles or horses. A representative of Mr. Whitney has characterized the whole story as being without foundation, adding that the acquisition of the general carriage companies would give the automobile companies controlled by Whitney interests no additional franchise privileges of value.

The Commercial Cable company of this city filed with the secretary of state on Tuesday a certificate of increase of capital stock from $10,000,000 to $15,000,000. The certificate declares that the liabilities of the company are $18,324,949. It is asserted that the additional $5,000,000 will be expended in laying another trans-Atlantic cable and for furnishing other facilities for improving the service.

Chief Croker of the Fire Department has selected an automobile for use in attending fires, and gave it a practical test last Saturday night, which resulted successfully. He applied to Park Commissioner Clausen for a permit to run his machine through Central Park when going to fires, but was refused the permission, Mr. Clausen claiming that the vehicle, being propelled by steam generated by gasoline, produced too much noise and would doubtless be the cause of frightening horses. Thus far permits have been given to but five automobile owners to operate in the park, their vehicles all being electrically operated. The automobile used by Chief Croker has been shipped to Havana, where it will be exhibited in connection with the fire department of that city.

It is expected that to-morrow electric underrtrolley cars will be running over the portion of the Forty-second street, Manhattanville and Amsterdam avenue system of the Third Avenue Railroad company from Fort Lee ferry to Seventy-first street where Broadway crosses Amsterdam avenue. The route will be through Manhattan avenue to Broadway and thence down the boulevard to the crossing. From Seventy-first street south, on Amsterdam avenue to Fifty-ninth street, the new electric road is nearly ready for use, and it is expected that the run of the electric cars will be extended to that point on Tuesday. The remainder of the electric route on Broadway from Seventy-first street to Forty-second street is complete and could be put into use but for the complicated crossing and switchback work that must be put in at some of the crossings.

At a meeting of the Board of Estimate Tuesday it was voted not to grant franchises to the Kings' Bridge Railway company or the Fort George and Eleventh Avenue Railroad company on the terms agreed to by the Municipal Assembly last July. The Municipal Assembly wanted to charge the railway companies three per cent. of their gross receipts for the first five years, and five per cent. thereafter. These terms were so amended by the board that the companies must pay four per cent. of their gross receipts for the first five years, six per cent. for the second five, eight per cent. for the third five, and 16 per cent. thereafter. M. L. G.

Canadian Intelligence.

Ottawa, Ont., December 9.—A check for $1,000 has been received by the town of Niagara Falls, Ont., from the company which proposes to convert the street railway of the town into an electric system. The Sutherland Improvement and Development company of New York is the promoter of the enterprise.

At a meeting of the stockholders of the Sarnia Street Railway company of Sarnia, Ont., the question of converting the line into an electric system was discussed. A by-law authorizing the directors to raise $60,000 by debentures for carrying out the work was passed.

Mr. T. E. Mitten, general superintendent of the Milwaukee Electric Railway and Light company of Milwaukee, Wis., and Mr. E. W. Olds, superintendent of rolling stock for the same company, were in Montreal recently for the purpose of acquiring information in connection with the working of the Montreal electric street railway.

Hon. Fred Peters, ex-premier of the province of Prince Edward Island, now a partner of Sir Hibbert Tupper, practicing law in British Columbia, and E. J. Fader of Vancouver, B. C., have started a bold scheme to harness the Pacific Ocean. They propose to turn to account the power of the tide in both the first and second narrows in Vancouver harbor, and to operate a large electric power house, and have therefore applied to the government of Canada for certain foreshore rights. The federal authorities are consulting the City Council of Vancouver on the subject before granting the application.

Mr. J. H. Russell of Atlin, British Columbia, is about to purchase an electric plant for the purpose of supplying light and power to the towns of Atlin and Pine City in that province. He expects to have the lighting plant installed and in operation about the first of March next. The plant is to be operated by water power, which is to be obtained from the high falls of Pine Creek, three miles from Pine City; and it is the intention of the promoters to develop sufficient energy to supply power as well as water to the hydraulic workings in the vicinity.

Some interesting information respecting the telegraph line to the Yukon is given by Mr. J. B. Charleson of the Public Works Department, Ottawa, who superintended its construction. Mr. Charleson left Ottawa on March 10th last, and although skeptics ridiculed the claim of the department that the Yukon could be connected with Bennett in one season, a completed line is now the best answer. The exact distance from Bennett to Dawson is 740 miles, and the cost of the line was about $137,000. There were no horses engaged in carrying on the work of construction, most of the carrying being done by scows on the river. Where the Big Salmon River enters the Yukon, the former had to be crossed, the distance being 900 feet; the very rapid current preventing the laying of a cable, the wire was strung above the river at a height of 70 feet. Connection was made with Dawson at six o'clock on the evening of September 28th, and on that evening $400 was taken for messages. The line has already netted the Dominion government nearly $15,000.

Mr. J. D. Morrison of Toronto, Ont., is in Ottawa in the interest of the Western Union and Great Northwestern telegraphic code, the most complete code yet produced. This code having been placed in the offices of these companies, the Anglo-Amer-

ican Telegraph and Cable company, and in the offices of other companies throughout the world, enables a holder of a code to telegraph to any individual without considering whether his correspondent is supplied with the code or not. If the receiver of a message has not a code, he gets his message translated through the office of the company. The saving by use of the code is from four to 16 words for one, which makes it of value to anyone whose telegraphic expenses reach to four dollars per month or over. Another advantage to the subscriber lies in the fact that any person desiring to wire him may have the use of the code at the offices of the several companies. The code has been officially adopted by the Dominion government, cities of Montreal and Toronto and by the banks throughout Canada.

Mr. J. A. Culverwell of Toronto, Ont., the promoter of the Burleigh Falls, Peterboro and Lindsay electric-power enterprise, states that he has succeeded in making financial arrangements with a prominent New York banking-house for the completion of the undertaking. The company will be called the Central Ontario Power company. Burleigh Falls is situated 17 miles from the city of Peterboro, Ont., and 39 miles from the town of Lindsay, in the same circuit. Plans of the dam and power house have been completed, which are said to prove that the hydraulic development will cost less than any proportionate power development on the continent. The minimum flow of water in the dry season shows 3,000 horse power, while the reservoir capacity adjacent to the falls will give 4,500 horse power during the hours of heavy load. Contracted revenue for lighting and power in the several towns was secured during the past summer to the amount of $50,000 per annum of five and 10 years' duration. It is understood that work will be commenced shortly, the hydraulic development not being considered an extensive undertaking, the main dam being built and maintained by the government as part of the Trent Canal system, which probably makes a saving of an expenditure of some $100,000. Three 700 horse power generators and other requisite apparatus will be installed at the beginning, and allowance made in the power house for further increase. W.

PERSONAL.

Emil Grah, an electrical contractor and dealer of Toledo, was a Chicago visitor last week.

The marriage of Mr. Charles Tripler Child, technical editor of the Electrical Review of New York, to Miss Bertha May Cushing of Malden, Mass., is announced.

Rev. Daniel Shepardson, an eminent clergyman and the founder of the Shepardson College for Women at Granville, Ohio, died on December 9th at the advanced age of 86 years. George D. Shepardson, professor of electrical engineering in the University of Minnesota, is a son of the deceased.

Mr. J. H. Vander Veer, superintendent of motive equipment of the Brooklyn (N. Y.) Heights Railroad company, who presented a paper entitled "Maintenance of Car Equipment" before the recent annual meeting of the American Street Railway association at Chicago, died after a brief illness on December 3d.

Seizo Misaki of Kobe, Japan, chief engineer of the Hanshin Electric Railway company, and T. Ikeda of Nakanoshima, Osaka, Japan, chief engineer of the Osaka Electric Light company, who have been inspecting electric railways in this country for several weeks, expect to sail for Japan on December 16th.

Mr. S. W. Moon, prominent in the Independent telephone field, has resigned his position as general manager of the American Electric Telephone company to take the active management of the new Swedish-American Telephone company of Chicago. He is the treasurer and general manager of the new company. Mr. Moon was one of the pioneers in the Independent telephone movement, and he is also interested in other electrical lines, being president of the Laclede Battery company of Kokomo, Ind. Upon Mr. Moon's retirement from the American Electric Telephone company the employes made up a purse and presented him a fine gold watch and chain. Mr. P. C. Burns also showed his appreciation of Mr. Moon's services by a very substantial present.

ELECTRIC LIGHTING.

The electric-lighting plant of the York Light and Power company, located in Saco, Me., and which lighted Saco and part of Biddeford, was destroyed by a boiler explosion on December 6th. The damage was between $15,000 and $20,000.

ELECTRIC RAILWAYS.

Fire at the car house of the Quincy and Boston Street Railway company in Quincy, December 7th, destroyed the buildings and 17 cars. Connecting roads are loaning cars to the company temporarily and traffic continues. The loss is estimated at $55,000, covered by insurance.

In connection with the regular biennial convention of the International Street Railway association, which has chosen Paris as its place of meeting in 1900, a congress of all street-railway and tramway companies of the world, says the Street Railway Journal, will be held, under the auspices of the Paris Exposition authorities, on September 10th to 13th.

At a meeting of the City Council of Chicago on December 11th the mayor was authorized to appoint a special committee of seven aldermen which shall investigate and report regarding: Municipal ownership of street-car lines; compensation to be paid the city for renewals of old franchises or granting of new ones; other conditions regarding the granting of street-car franchises, such as transfers, methods of laying tracks, running of cars, etc.

Reports are again in circulation to the effect that the South Chicago City Railway company, the Chicago Electric Traction company and the Calumet Electric Street Railway company are to be consolidated. It is said that the combination is to be effected by a new concern that will pay $10,000,000 for the properties. It is reported also that the Chicago City Railway company may lease its lines south of Sixty-third street to the new company and make that street the dividing line for fares.

AUTOMOBILES.

It is reported that steam plows are to be used in South Africa for intrenching works.

An English physician has driven a motor carriage 5,000 miles at an expense of only $130.

The ordinance passed by the City Council of Chicago on July 6th establishing a board of examiners for operators of automobiles is to be enforced. The board consists of the city electrician, city engineer and health commissioner.

The Philadelphia Evening Bulletin uses an electric vehicle in delivering its papers. It is asserted that the automobile effects a saving of about 25 per cent. over the horse in the time consumed in delivering the papers along the various routes and enables the Bulletin to place its papers at the most distant point of the city within half an hour after leaving the presses.

The electrically operated hose cart designed and constructed by the technical section of the Paris Fire Brigade, and recently described in the Western Electrician, is said to have stood the test of practical experience. At several fires it arrived before engines and hose carts drawn by horses. The Fire Department has ordered six other electric fire-extinguishing machines of different models, including a hook-and-ladder truck, which will be used, should occasion demand, in connection with the exposition of 1900.

The automobile is becoming quite popular in Buenos Ayres. The vehicles, which are of the electric and petroleum types, include not only private carriages and tricycles, but also heavy delivery wagons, for the use of large stores. As a step to advance the automobile interests, there has been formed the Argentine Touring Club, which is endeavoring to establish in all provinces of the Argentine Republic roads to be specially reserved for bicycles and light automobiles. These roads have already commenced to radiate from Buenos Ayres to a distance of 60 to 70 miles, and it is intended to continue the work until a good system of roads is established throughout the country.

TECHNICAL SCHOOLS.

The United Correspondence Schools of New York city have a course of study in mechanical engineering especially designed to meet the needs of machinists, inventors, draughtsmen, tool makers, machine-shop laborers, pattern makers, boiler and engine builders, shop foremen, molders and foundrymen, blacksmiths, engineers, builders and salesmen of machinery and others. The system of practical education by mail is employed, and the pupils, who are said to be scattered throughout the world, do their studying in leisure hours at home. The company says that tuition is moderate and is accepted in small monthly payments. It requests all persons interested in the subject to write to it at 154-158 Fifth avenue, New York city.

PUBLICATIONS.

The Electric Appliance company, Chicago, has issued pamphlets describing the different styles of Adams-Bagnall enclosed arc lamps.

The American Electric Telephone company of Chicago is distributing, with its compliments, a handsome 1900 calendar. It represents the striking figure of a beautiful woman.

The second edition of "Wiring Tables: How They are Made and How to Use Them," by Thomas G. Grier, has just been issued. The book has been thoroughly revised and enlarged and is presented in pocket size, with flexible leather covers. It is sold by the Western Electric company of Chicago.

A handsome catalogue of the Thompson-Ryan dynamo and the McEwen automatic engine has recently been issued by the Ridgway Dynamo and Engine company of Ridgway, Pa. Considerable expense has been entailed in the production of the catalogue, as is shown by the fine illustrations, paper and letter-press. Complete descriptions are given of both the engine and dynamo and a number of full-page pictures illustrate the different types of machines and some of the installations of the company's direct-connected units. Tables are given showing the sizes, capacities, speed, weight and other data of both engines and generators. Copies of the catalogue will be furnished on a request, accompanied by a business card.

The Macmillan company of New York announces a new "magazine of contemporary thought," The International Monthly, to be published in America and England. In each number there will be not less than five essays. Scientific articles will be prominent. Prof. John Trowbridge will have an article on "Recent Advance in Physical Science" in the January number, and an essay by Oliver J. Lodge is announced.

The Union Traction company of Indiana, of which mention was made in last week's number of the Western Electrician, has issued the "Union Traction Quarterly," a publication containing information on matters pertaining to the company. It contains a map of the interurban system, showing the lines in operation and those under construction. Special features are time-tables of the different interurban lines and of the steam railroads at points of intersection with the lines of the company. Several topics relating to electric-railway matters are briefly discussed, and the street railways of Anderson, Ind., the headquarters of the company, are made the subject of a short historical sketch. The complete telephone plant and block-signal system operated by the company are briefly described.

ELECTRICAL SECURITIES.

The Chicago City railway has declared a dividend of 3 per cent., payable December 30th to stockholders of record December 15th.

Directors of the South Side Elevated Railroad company of Chicago have declared a four-month dividend of one per cent., payable December 30th. This makes three per cent. on the stock for the year ending December 31, 1899.

MISCELLANEOUS.

On the night of December 5th fire damaged the armature forming and insulating department of the General Electric company at Schenectady, N. Y., to the extent of $10,000. The fire was caused by the spontaneous combustion of gases in a large gasoline tank.

In the extensive German exhibit of machinery promised for the Paris Exposition there will be several large electric generators, ranging from 1,400 to 2,000 horse power in capacity, displayed by Siemens & Halske, Schuckert, Lahmeyer and the Helios company.

TRADE NEWS.

The J. G. Brill company of Philadelphia has received an order for 12 trucks to be used on the electric-railway cars of Barcelona, Spain.

The Mayer Engineering company of 1401 Monadnock block, Chicago, announces that it is prepared to do a general engineering business, develop inventions, make technical translations, furnish drawings, etc. Mr. George M. Mayer, the electrical engineer of the company, has had a varied experience in England and the United States, and is a member of several scientific and engineering societies.

The Ball Engine company of Erie, Pa., is pleased with the business now doing and in sight. It notes that the engine which is to furnish the electric light and motive power for the special machinery exhibit of the United States at the Paris Exposition left New York a short time ago on the United States transport steamer Prairie. This engine, which is a tandem-compound of 350 horse power, direct-connected to a generator, was built by the Ball Engine company.

The Standard Underground Cable company of Pittsburg feels elated over the fact that the National Export Exposition, recently held at Philadelphia, awarded it a silver medal, a diploma and "the blue ribbon," these being, it is said, the highest honors awarded to any manufacturer's exhibit. The award was made for "the most complete exhibit ever made" of submarine cables, telephone cables, power cables, both for alternating and direct current, high and low-pressure cables, street-railway cables and high-grade rubber-insulated wires, and also for the completeness of the working models.

The Farr Telephone Construction and Supply company, Chicago, one of the largest telephone and construction supply houses in the country, has recently issued an electric-light supply catalogue. The Farr company says that it is in a position to furnish anything used in electric-light stations and to quote prices that usually secure the business. The company has gained an enviable reputation through its dealings with the telephone people, and President C. W. Farr states that the company is now able to fill promptly the wants of electric-light men, as well as of telephone exchanges.

In the patent litigation entered into between the Chicago Pneumatic Tool company, Joseph Boyer, the Standard Pneumatic Tool company and the Chonteau Manufacturing company, all suits have been dismissed by the advice of the respective attorneys, the litigants recognizing that the Boyer and Chonteau patents cover the fundamental prin-

ciples of all pneumatic hammers, without the combined use of which no successful pneumatic hammer can be made. Recognizing the value of the respective claims, the companies have purchased licenses from one another covering their present style of hammers, this action being necessary for the protection of users of their respective tools.

The Western Electrical Supply company of St. Louis states that it has recently taken the exclusive territorial agency for the New Clifton iron-armored insulating conduit in the South and West, covering some 20 states. This conduit has been approved by the national board of fire underwriters, and everyone who has used it is reported to have been more than pleased. It is hard-rubber lined and can be bent in any shape, thus dispensing with all elbows, and cheapening the cost of both labor and material. The company claims that it is easier to draw the wires into this conduit than into any other on the market, as the pipe is freed from burrs and made smooth before lining. The pipe is then lined and a finishing coat of soapstone is put on, thereby making a smooth surface. In addition, it is claimed that it is less expensive to use than some other conduit, as single-braid wire is approved by the underwriters in this conduit.

The Falcon attaching plug and flush receptacle, a recent production of the Falcon Electric Manufacturing company of New York city, is asserted to be the most advanced design of its kind on the market. Combined with durable mechanical construction it has the advantage of being easily installed. Fitted for the Universal outlet box, it is arranged for front connections, so that no "slack wire" has to be left in the outlet box. It can be completely installed and connected without the face plate, thus affording a safe method for protecting the polished surface of the latter from being scratched by the workmen. The face plate itself is provided with a lid for closing flush with the floor or wall when the plug is withdrawn. The plugs are provided with fuse connections for both poles, and can be interchanged without decreasing the electrical contact, as the variation in the molded porcelain is overcome by a stiff contact spring.

The Eureka Electric company of Chicago announces that it has secured the exclusive right from the Rolfe Electric company to manufacture and sell that company's protective devices, including lightning arresters, cable heads, combination and current protectors, cross-connecting boards and all devices employing the principle of heat-coil protection, under the Rolfe and Barrett patents. Realizing the importance of this branch of the telephone business, the Eureka company has made a separate department, which will be under the direction of Mr. Charles A. Rolfe, a telephone expert of over 25 years' experience. Mr. Rolfe was formerly associated with the Utica Fire Alarm and Telegraph company and the Gamewell company, and is said to have built the first telephone exchange in the United States in opposition to the Bell company at Utica, N. Y. The Rolfe protectors have the indorsement of the underwriters, the World's Columbian Exposition, a large number of Bell telephone exchanges and over 100 cities of the United States where the protective devices are used in the fire-alarm and police-telephone systems. These protectors are said to be the only ones which have been tested for all classes of low-tension innocuous circuits during long periods of service. The Eureka company will cheerfully furnish circulars describing its full line of apparatus upon application.

BUSINESS.

The Sargent company of South Chicago, manufacturer of iron and steel castings, is increasing its facilities and has placed an order with the Western Electric company for one 150-kilowatt, 125-volt belted generator.

There is nothing more true than that "Poor goods spoil one's temper." This truth seems to have something to do with the large increase in the sale of Eureka packing. The manufacturers, James L. Robertson & Sons, 198 Fulton street, New York, state that the sales of Eureka packing at the present rate will almost double those of any other year. This packing is used almost all over the world and in a great many electric plants.

Mr. W. R. Mason, the St. Louis representative of the Siemens & Halske Electric company, takes a natural interest in the plant of the Imperial Electric Light, Heat and Power company of St. Louis, illustrated in this issue. The plant is equipped with three 500-kilowatt, 500-volt, Siemens & Halske generators, direct-connected and running at 150 revolutions per minute. The company has lately ordered two additional 500-kilowatt Siemens & Halske generators to run at 100 revolutions.

James Clark, Jr., & Co., Louisville, Ky., manufacturers of Willey multipolar dynamos and motors, report an active business during the last few months. Willey machines are said to possess a number of special features which have enabled the manufacturers to obtain a ready market for them. Clark & Co. also place on the market a number of other special machines, such as direct-connected machine tools, etc., and their business has assumed such proportions that they have been obliged to seek larger quarters.

A shop whose belts are not running as tight as fiddle-strings is rather an unusual sight; but the Erie railroad Union dry docks of Buffalo, N. Y., reported on March 2, 1896, to the Cling-surface Manufacturing company of Buffalo, N. Y.: "Cling-surface has increased our power very considerably; belts soft, pliable and in simply perfect condition. Cling-surface has earned many times its cost." On October 20, 1899, they again report: "We have not a tight belt in the shop and are better satisfied than ever with Cling-surface."

M. Goldsmith of the firm of Goldsmith Bros., Chicago, the well-known refiners, has just returned from a trip South, where he met with gratifying success. Mr. Goldsmith states that his firm is rushed with orders and that the factory is working harder than ever before in its history in order to keep up with the growing business of the company. The demand for platinum has never been as great as it is at present, and the facilities of Goldsmith Bros. are said to be taxed to their utmost. Goldsmith Bros. make a specialty of purchasing scrap platinum, for which they pay the highest market price.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, Ill., report that their December business has started in unusually brisk. At their factory, Beloit, Wis., they have just added new boilers and engines, supplementary to water power, and are working overtime. They are receiving numerous orders for their Helmet bronze in sheet for flat springs and in wire for round springs. They carry a large quantity of this material in stock at their Chicago store and, therefore, are prepared to make immediate shipments. Owing to the many advances in raw material, there have been a number of changes in prices in standard machinists' tools and supplies, and Besly & Co., therefore, suggest that orders for the above be placed at once, as they will not make advances on these goods until after January 1, 1900.

The Bullock Electric Manufacturing company of Cincinnati states that the great volume of business which the company has received from all parts of the world during the last six months has made it necessary to extend its main building 200 feet. This will make the main machine shop 500 feet long and 200 feet wide. November is said to have been the best month for business that the company has ever experienced. Fifty-one machines were sold, including a number of repeat orders. Among the more important sales were the following: Willson Aluminum company, Holcomb's Rock, Va., 1,800 kilowatts in generators; Manchester (Eng.) Sporting Chronicle, 300 kilowatts; L. L. Summers, Florence, Colo., 150 kilowatts and 170 horse power in motors; John Wanamaker, Philadelphia, 100 kilowatts and 150 horse power; Arthur Pearson (Pearson's Magazine), London, Eng., 150 horse power; Oakland (Cal.) Transit company, 60 horse power; American Type Founders' company, Cincinnati, 30 kilowatts.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 5, 1899.

638,230. Binding Post and Connection for Electrical Apparatus. Alexander Fischer, New York, N. Y., assignor to Albert R. Shattuck, New York, N. Y. Application filed May 1, 1899.

A water-proof electrical connection is described consisting of an externally threaded binding post fitting in an internally threaded cylinder covered with non-conducting water-proof material.

638,232. Electric Exercising Apparatus. Charles L. Fortier, Milwaukee, Wis. Application filed December 12, 1898.

An exerciser, comprising a movable electrode and retracting resistance, is combined with a source of electricity generated independently of the exerciser, and means for changing the direction or polarity of the current through the electrode.

638,236. Electric Heater. Edward E. Gold, New York, N. Y. Application filed June 1, 1898.

The heater comprises an open helix of resilient resistant wire combined with a substantially straight supporting rod extending within it, the helix conformed relatively to the rod to press elastically against the rod on different sides thereof so that it clings thereon, and having in each loop or convolution a length of wire exceeding the circumference of the rod, so that the greater portion of its wire is out of contact with the rod and exposed to circulation of air.

638,249. Electrical Exchange. Alexander E. Keith, John Erickson and Charles J. Erickson, Chicago, Ill., assignors to the Strowger Automatic Telephone exchange, Chicago, Ill. Application filed December 16, 1895.

Combined with a series of contact points arranged in groups are a switch provided with an arm for each group, a series of contact points mounted independently of the switch but in electrical communication with the different arms, and a selector or auxiliary switch-arm rotatively and longitudinally movably mounted upon the switch, and means for establishing electrical communication with either of the groups through the selector.

638,278. Electrode and Process of Making Same. Isaiah L. Roberts, New York, N. Y. Application filed November 17, 1894. Renewed December 31, 1898.

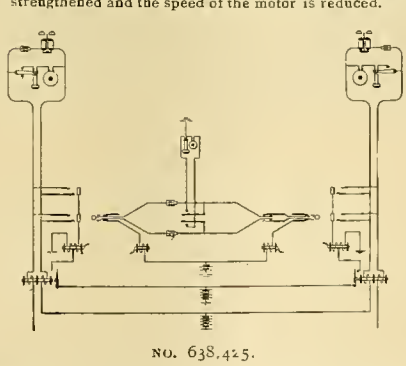
The process consists in heating a mixture of pulverized glass and carbon, and then subjecting the mixture to pressure while the glass is in a soft or plastic condition, thereby causing the adherence of the glass particles.

638,281. Automatic Electric Elevator. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing company, Chicago, Ill. Application filed July 18, 1898. Renewed October 4, 1899.

The elevator has a hoisting motor, a controller therefor, and mechanical connections arranged to be actuated from any landing for operating the controlling mechanism, whereby the motor may be started automatically from any landing and arrested when the car reaches that landing, the connections including means for indicating the location of the car.

638,282. Automatic Electric Elevator. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing company, Chicago, Ill. Application filed February 6, 1899.

In the elevator means are provided for automatically shunting a part of the motor-armature current through the motor field of the hoisting motor as the car approaches any predetermined stopping point, whereby the field is strengthened and the speed of the motor is reduced.



NO. 638,425.

638,333. Electric Rolling-machine Indicator. Adelbert P. Hine, Torrington, Conn. Application filed April 21, 1899.

A system for indicating the operation of a rolling machine is mentioned which combines with a source of electrical energy, main conductors, a make-and-break device in one of the main conductors adapted to be continuously operated, a rolling machine and an electrical counter arranged in series across the conductors but having the circuit in which they are included normally open, and a device adapted to close the circuit when the machine is in operation.

638,388. Electric Heater. Edward E. Gold, New York, N. Y. Application filed June 20, 1898.

The heater has a normally straight coil of resilient resistant wire, and a supporting rod therefor extended within it in generally straight direction and bent repeatedly back and forth to form zigzag sinuosities so as to distort the coil.

638,390. Storage Battery. William W. Hanscom and Arthur Hough, San Francisco, Cal. Application filed April 6, 1899.

A method of manufacturing electrodes for storage batteries is described.

638,408. Electrically Controlled Lock-collecting or Other Box. Frederick Williams, Revere, Mass. Application filed March 27, 1899.

The invention consists of a series of receptacles or boxes, each of which has a drawer, door or cover, a lock for locking the drawer, door or cover in its closed position, the bolt of which is adapted to be withdrawn and shut by a key, a bolt-latch for locking the bolt in its locking position, a magnet to remove, when energized, the bolt-latch from the bolt and means for energizing each magnet from a box or station immediately preceding in order.

638,418. Appliance for Telephone Switchboards. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed April 10, 1897.

The appliance has a base with a vertical perforation and a countersunk upper portion constituting the plug-socket, a tube longitudinally movable in the perforation and switch contacts actuated by the tube in its longitudinal movement, the tube having flattened longitudinal faces formed on it to permit the escape of dust from the socket.

638,419. Inking Device for Telegraph Registers. Louis E. Oehring, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed February 26, 1898.

A signal-receiving electromagnet intermittently moves a stylus wheel to and fro to engage the tape and register the telegraphic signals thereon.

638,422. Current-supply Circuit for Telephones. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed August 1, 1895.

A telephone line is combined with a charging battery in the main circuit, several local storage batteries at different sub-stations included serially in the line-circuit, a telephone at each station in the bridge between the conductors of the line-circuit, a return circuit for the charging current connected with the line beyond the last station, and an impedance coil in the return circuit.

638,423. Signal Lamp and Socket. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed March 20, 1897.

In combination are a base having a tubular socket therein, an incandescent lamp in the socket, contact pieces forming terminals of the filament carried upo

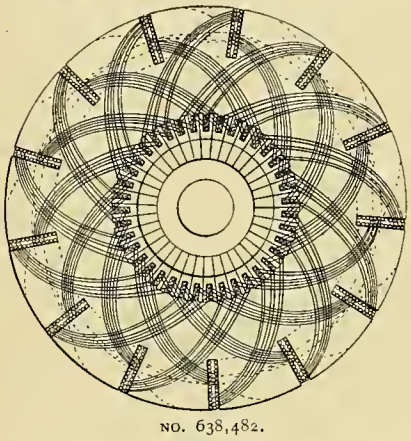
opposite sides of the lamp, and contact springs in the socket engaging the terminal pieces, a recess formed in the wall of the socket and a projection of glass formed integral with the lamp-bulb entering the recess.

638,424. Thermal Protector. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed March 22, 1897.

Two separable bodies are combined with a conductor forming part of an electric circuit wound upon one of the bodies, and two other bodies or surfaces, mechanically associated one with each of the first-mentioned bodies and united by fusible conducting cement.

638,425. Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed April 23, 1897.

Combined with a telephone line, a source of current and a relay therein, and means at the sub-station of the line for determining the flow of current in the line during the use of the telephone are a local circuit controlled by the relay, a source of current therein, an electromagnetic signal associated with the line having a winding included in the local circuit, a second local circuit including a winding differential with respect to the first-mentioned winding, a spring-jack and a plug for making connection with the line, and registering switch contacts in the spring-jack and plug adapted to complete the second circuit. (See cut.)



NO. 638,482.

638,426. Supervisory Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed February 14, 1898.

Two telephone lines each provided at its station with a switch for determining the flow of current in the line during the use of the telephone are combined with a bridge of the circuit, a supervisory signal and a source of current in the bridge, a magnet winding in a line conductor to each station between the station and the bridge, a normal break of the line circuit between the bridge and the calling station, and switch contacts actuated by the magnet windings adapted to close the break when the winding in circuit with the called station is excited.

638,430. Electric Arc Lamp. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed August 6, 1898.

Electromagnetic regulating mechanism for raising and lowering a vertically movable clutch is combined with a movable stop wherewith the clutch is adapted to engage, such eogagement causing the clutch to relax, means for ioterposing the stop in the path of the clutch after the initial raising of the carbon, and a vertically movable part operated by the regulating mechanism, ascending when the clutch descends and descending upon ascent of the clutch, adapted when lifted to remove the stop from the path of the clutch.

638,470. Trolley Wheel. John L. Osgood, Buffalo, N. Y. Application filed August 8, 1898.

The wheel comprises a peripherally screw-threaded bushing, a center disk screwed upon the middle portion thereof, two side plates stamped into shape and each bent or offset to project slightly over the periphery of the disk, and then curving or flaring outwardly and nuts screwing upon the bushing to lock the whole together.

638,471. Telephone Switch. Samuel B. Rawson, Elyria, O., assignor to the Rawson Electric company, Elyria, O. Application filed December 15, 1897.

A plug switch is described which combines a signal shutter, a plug switch provided with projecting arms, and means for rotating the plug switch to cause its arms to engage the shutter and close it.

638,472. Secondary Battery or Accumulator. Charles J. Reed, Philadelphia, Pa., assignor to the Security Investment company of Pennsylvania. Application filed December 31, 1895.

There is described a method of preventing deleterious effects in a secondary battery in which active material is deposited upon one electrode or set of electrodes from the battery solution during the charging operation, which consists in subjecting detached particles of active material to localized electrolytic action whereby they are redissolved into the battery solution.

638,478. Signaling Apparatus. Jens G. Schreuder, Edgewood Park, Pa., assignor to the Union Switch and Signal company, Swissvale, Pa. Application filed September 1, 1899.

The apparatus combines an electric motor, a signal, independent electrically controlled connections from the signal to the motor, two shifting circuits each including the motor and one of the magnets of the connections between the signal and motor, and a make-and-break mechanism controlling the circuits and controlled by train movements.

638,479. Electric Advertising Device. Josiah Scott, Toledo, O. Application filed March 10, 1899.

The device comprises a box or casing having a transparent top or face provided with an opaque and removable surface of pigment, a source of light within the box, a plurality of metallic strips embedded in the transparent face connected to one side of an electric circuit, a pencil in connection with the other side of the circuit, a resistance interposed in the circuit, whereby the sentence traced by the pencil on the face will appear illuminated and an arc will be produced intermittingly.

638,480. Toll-collecting Appliance for Telephone Stations. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed June 5, 1896.

In combination with a telephone line are a line annunciator responsive to currents of constant direction, a clearing-out annunciator responsive to alternating currents, and means for associating the clearing-out annunciator with the line, a generator of alternating sigoaling current at the sub-station of the line, a shunt of the generator normally open at two points, a commutator on the generator adapted to close the shunt at one point during half of each revolution, a coin chute, and switch contacts operated through the agency of a deposited coin connected to close the shunt circuit at the other point.

638,482. Electric Generator or Motor. Norman W. Storer, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed July 28, 1899.

A direct-current generator or motor is described consisting of an armature having a core provided with slots and a plurality of coils located io the slots, in combination with a commutator to the bars of which armature leads are connected in multiple, the conductors in each slot which are connected in multiple being located side by side. (See cut.)

638,511. Electric-lighting Apparatus for Vehicles. Gustavos Heidel, St. Louis, Mo., assignor to the Globe Electric company, St. Louis, Mo. Application filed January 21, 1899.

The armature shaft of a dynamo is driven by means of a friction wheel adapted to bear against a rotary part of the vehicle.

638,512. Electric Arc Lamp. Gustavos Heidel, St. Louis, Mo., assignor to the Globe Electric company, St. Louis, Mo. Application filed March 8, 1899.

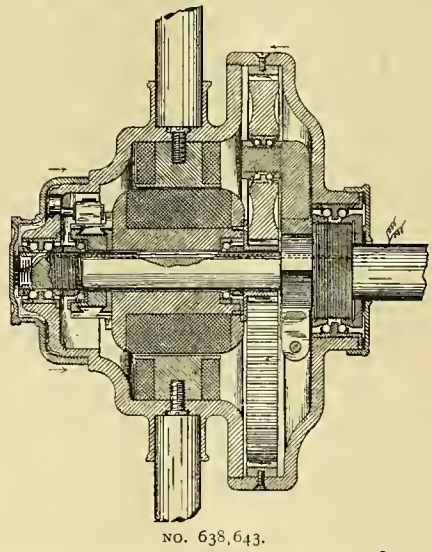
The lamp has an upper pencil holder, a lower pencil holder, a stem on which the lower holder is supported, a pair of sheaves, a convolute spring coiled within the sheaves and having its ends connected to them respectively, and a pair of cords each of which has connection with the stem.

638,521. Telephone Switchboard. Seymour Morrison and Thomas L. Springer, McCordsville, Ind. Application filed May 19, 1899.

A self-contained operator's cam and clearing-out drop for telephone switchboards is described. It has a cam-stem, answering-plug lines and ringing-plug lines, an operator's circuit and a generator circuit terminating on the stem, a frame work on the stem, an electromagnet in the framework, a switch for electrically connecting the plug lines, the electromagnet and the operator's circuit and for electrically connecting either of the plug lines, with the generator circuit, an annunciator, and means for automatically, mechanically restoring the annunciator by the movement of the switch.

638,522. Electric Motor-controlling System. Frank B. Rae, Chicago, Ill. Application filed February 18, 1898.

Combined with a motor and a commutating switch are two sources of electricity, an armature coil, a plurality of separate field-magnet coils on the motor, and separate connections from the field-magnet coils, from the armature coil and from the sources of electricity to the commutating switch.



NO. 638,643.

638,542. Portable Boat Motor. George F. Atwood, Chazy, N. Y., assignor of one-half to William W. Wood, Wood's Falls, N. Y. Application filed June 7, 1899.

An electric motor is arranged in a casing on the rudder post of the boat and is connected to an electric generator. A handle controls the steering of the boat, and also operates a motor-controlling device.

638,545. Electric Arc Lamp. Edward H. Belden, Jackson, Mich. Application filed October 19, 1898.

The lamp has a frame consisting of a tubular guide for the upper carbon and a tubular guide for the lower carbon, the guides being in vertical alignment, in combination with platforms secured to the guides and adapted to support the operative mechanism of the lamp, and a tube interposed between the upper carbon and its tubular guide.

638,546. Electric Arc Lamp. Edward H. Belden, Jackson, Mich. Application filed October 21, 1898. Renewed October 17, 1899.

A cleaner is moved in the globe of the lamp by the carbon-carrying mechanism.

638,579. Recording Apparatus. Edwin C. Hegan, Louisville, Ky. Application filed June 23, 1898.

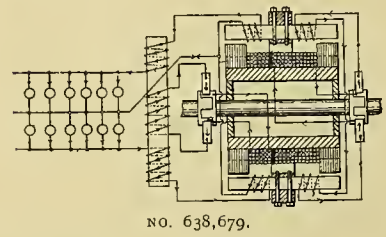
There is described the combioation of a recorder having numbering devices, a signal box, two relays actuated by currents controlled by the signal box, and electromagnetic devices respectively controlled by the relays, one serving to place the numbers of the numbering apparatus in operative position, and the other serving to control the action of the first electromagnetic devices, to form the spaces between the numbers.

638,606. Electric Signaling Apparatus. Herbert B. Taylor, Newark, N. J. Application filed April 27, 1899.

Combined with signal mechanism provided with means tending to move it to danger position are an electromagoet and two pivotally mounted levers, one of which carries an armature for the electromagnet and is adapted to engage by a hook connection with one end of the other lever, the other end of the lever being adapted to engage with the signal mechanism to hold it in safety position, so that the two levers form a compound lever lock for the signal mechanism.

638,607. Railway Signal. Herbert B. Taylor, Newark, N. J., assignor to James Wayland, Newark, N. J. Application filed January 24, 1899.

The apparatus comprises a semaphore having one or more electric lamps mounted on its blade, a circuit-closer for the lamps in a supply circuit operated by the movement of the semaphore, aod an auxiliary circuit-closer in the supply circuit controlled by a relay in a track circuit, the auxiliary circuit-closer depending for its operation on the position of a train on the track.



NO. 638,679.

638,614. Electric Arc Lamp. Ernst Woltmann, New York, N. Y., assignor of one-half to Albert Anderson and Johan M. Anderson, Boston, Mass. Application filed March 19, 1898.

The following instrumeotalities are combined in the lamp: A carbon-lifting magnet provided with an armature, and a clutch mechanism operatively connected to the armature, and comprising a carrier and toggle levers pivoted to the carrier on opposite sides of the carbon to be lifted and having their free ends in engagement with each other and moving toward a horizontal line through their pivots wheo the carbon is lifted, and jaws to engage the carbon carried by the levers.

638,627. Multiple-blade Starting Switch. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler company of New Jersey. Application filed April 29, 1899.

The invention is a rheostat comprising a set of switches, a bar to prevent the closure of contact at the switches and notches in the bar shaped and positioned to prevent closure of contact at the switches except in definite order.

638,631. Magnetic Switch-operating Mechanism. Thomas F. Green, Pittsburg, Pa. Application filed October 5, 1899.

Means are applied to a car for setting a switch consisting of magnets located to come upon opposite sides of the switch point or movable part, and means are provided for moving the magnets vertically to bring the switch point or movable part within their magnetic field.

638,635. Dynamo-electric Machine or Electric Motor. Gustavos Heidel, St. Louis, Mo., assignor to the Globe Electric company, St. Louis, Mo. Application filed March 1, 1899.

The machine consists of the combination of a suitable frame, an armature mounted therein, pairs of magnets having hollow cores, and pole pieces having projections extending within the hollow cores, and thereby rigidly connectiog each pole piece with two cores and making a rigid self-supporting structure of the magnet, whereby it may be mounted at its respective ends upon the frame of the machine.

638,643. Means for Propulsion of Vehicles by Electricity. Fred J. Newman and Josef Ledwinka, Chicago, Ill. Application filed May 19, 1899.

The hubs of the wheels of the vehicle inclose each an electric motor, the motors being journaled on the axles. The shells of the hubs contain each a motor-field magoet, the armatures of the motors being connected each by gear-wheels with its hub-shell; when the armatures are revolved, the revolving motion thereof is transmitted to the wheels of the vehicle. (See cut.)

638,679. Alternating-current Generator. Thomas H. Hicks, Detroit, Mich. Application filed January 2, 1895.

In combioation with a work-circuit having three main-line conductors and its translating devices arranged in multiple-series system, are a regulating inductorium having two sets of series coils, one of them being connected to one of the work-circuit conductors, and the other being connected to another of the work-circuit conductors, and a generative armature circuit having three conductors leading therefrom, one of the armature conductors being connected to one of the inductorium series coils, another of the conductors being connected to the other of the coils, aad the third conductor being connected to the third work-circuit conductor. (See cut.)

638,680. Push-button. Percy C. Howe, Boston, Mass. Application filed June 10, 1899.

The device comprises a base, circuit terminals fastened thereto, inner and outer movable contact members mounted on the base, a metallic thermostat interposed between the two members and adapted to act on the inner member, and a push-piece arranged to act on the outer member.

DESIGN.

31,919. Dial for Electric Meters. Hiram Percy Maxim, Hartford, Conn., assignor to the Columbia and Electric Vehicle company, Hartford, Conn., and Jersey City, N. J. Application filed October 27, 1899. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXV. CHICAGO, DECEMBER 23, 1899. No. 26

Electrical Features of the Fine Arts Building.

Less than two years ago the 10-story building located at 203-207 Michigan boulevard, and occupied until that time as the Chicago carriage and wagon repository of the Studebaker Bros. Manufacturing company, was entirely remodeled and converted into a music hall and office block and named the Fine Arts building. Studebaker Hall, a large concert hall, with a seating capacity of 1,700, occupies the greater portion of the first three floors. The rest of the building is devoted to University Hall, with a capacity of 700, an assembly hall, a lecture hall and studios and offices for musicians and artists.

Originally the plans contemplated the installation of a steam and electric plant, which was to be placed in a portion of the basement. It was found, however, that the necessary steam and electricity could be obtained at a low figure from the adjacent Auditorium power plant, so the isolated plant was abandoned.

The current comes from the Auditorium through three pairs of 1,000,000 circular-mil cables (one power and two light circuits), at a pressure of 115 volts, to a large two-panel white-marble distributing switchboard in the basement, from which the light and power circuits for the entire building are controlled. This board is illustrated in Fig. 3, on page 364. It has 10 circuits for lights and five for power.

At the top of the board are two of the latest type Thomson recording wattmeters. The larger one at the left has a capacity for 2,500 amperes and is connected in the two light circuits; the smaller one has a capacity for 1,200 amperes and is in the power circuit. Directly below are four Weston illuminated-dial station meters, three being ammeters and one a voltmeter. The meter on the right is a 125-volt voltmeter, with suitable connections for taking a reading of the power or light circuits or of the ground detector. The next meter is a 750-ampere ammeter, by means of which a reading of any circuit on the switchboard may be taken. This is accomplished by a segment switch, with a number of contacts connected to shunt strips on the back of the board, one for each circuit. The third instrument is a 1,000-ampere ammeter, connected to the main power cables, and gives a reading of the total amount of current used for power. The total amount of current used for lighting purposes is indicated by the last meter on the left, which is a 2,000-ampere ammeter, and is connected to the main light cables. Below the meters are one 400-ampere, four 50-ampere and five 200-ampere switches, controlling the lighting circuits of the building. Five 300-ampere power switches are next below on the board, and at the bottom of the panels are five Ward Leonard circuit-breakers.

The 15 circuits from this board supply current to about 4,500 incandescent lights, eight arc lamps and 140 horse power in motors. Directly back of the distributing board is a wattmeter board of black polished slate, on which is mounted a Thomson recording wattmeter for each of the circuits leading from the switchboard. These meters afford a means of checking up with the main meters the total amount of current used, as well as indicating the current used on the individual circuits. The building is wired with Simplex wire placed in loricated conduit, the three-wire system being used throughout. The present voltage maintained on all circuits is 230 volts, but the lighting circuits are adapted to be converted into a 220-volt system.

The electrical features of Studebaker Hall are of special interest. This hall is being used at present by the Castle Square Opera company, which is filling a 40-week engagement. Although the auditorium of the house is fitted as a concert or music hall, the stage is equipped with all the appliances and appurtenances of a modern theater. The switchboard, located at the south end of the stage, is a very complete one. It comprises three panels of pink Tennessee marble and adjacent to it is a three-panel fuse-board of brown slate. Fig. 1 shows the front of the switchboard, with the corrugated-iron curtain used to protect the board raised above it. On the board are placed the necessary switches for the main and theater circuits, while above are seen the handles and controlling apparatus for the theater dimmers. These dimmers, 22 in number, are placed directly above the switchboard, and a portion of them show in the illustration, above the iron curtain. The mains leading from the distributing to the theater board contain copper equivalent in area to 2,000,000 circular mils.

When the building was remodeled and Studebaker Hall fitted for concerts the switchboard and fuse-board were built on the same frame and placed back to back. Last summer the stage was built over and added to for the accommodation of the opera company, and it was found necessary to move the board 14 feet and rebuild it for theater work. The original frame was utilized to carry the switchboard and dimmers, with some alterations, and the fuse-board was mounted on a new frame and placed at an angle of about 120 degrees to the larger board. The fuse-board is protected with a wire grating. This new arrangement makes both boards easily accessible to the stage electrician, and in case of a fuse blowing out he does not have to leave the front of his switchboard to replace it. In changing the boards it was necessary to rebuild one panel of both boards and also to change the plan of wiring. Fig. 1 represents the theater switchboard as it stands at present, and Fig. 4 is a diagram of the connections between the receiving bus-bars, the switches and fuses. The wiring circuits are shown from the point where they leave the buses, passing through the main and circuit switches and fuses to the point of leaving the individual circuit switches for distribution throughout the house.

The wiring of the boards is artistic as well as original. It is all protected and thoroughly insulated with circular-loom conduit, and the work is so arranged that every connection can be reached with ease. This feature and the general appearance of the boards reflect credit on Mr. H. T. Whyte, the engineer for the Fine Arts building, who originated the design and superintended the work. Fig. 2 is a view of the back of the two boards, showing the circular-loom work.

On the switchboard are switches for five sets of border lights, each set containing 42 white, 20 red and 20 blue lamps, one set of footlights, with 32 lamps each of white, red and blue, and one proscenium strip with 12 each of red, white and blue lights. Each color in each set is controlled by a dimmer, all the dimmers being so arranged that

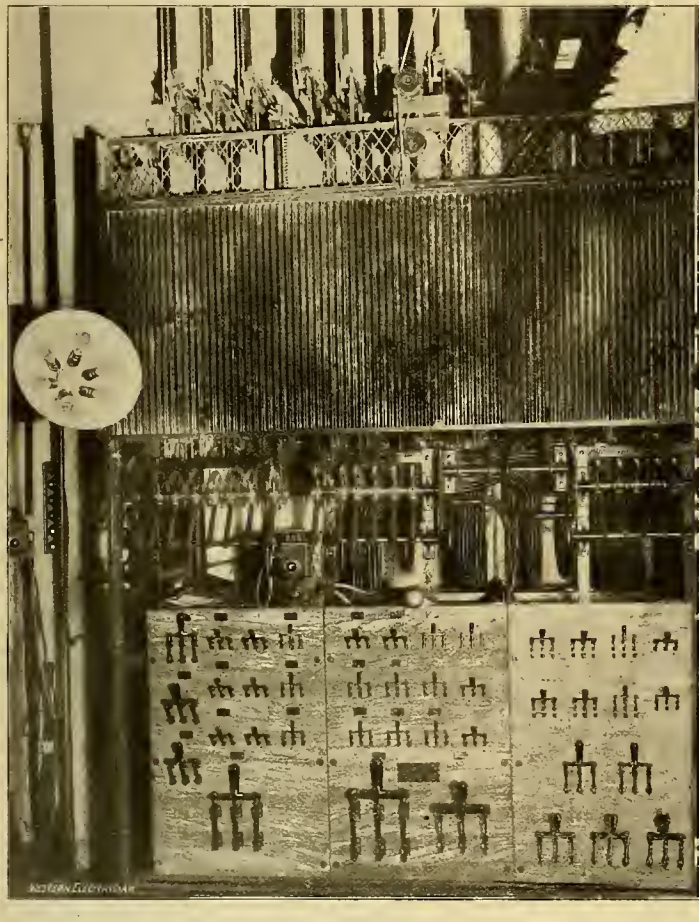


Fig. 1. Theater Switchboard and Dimmers.

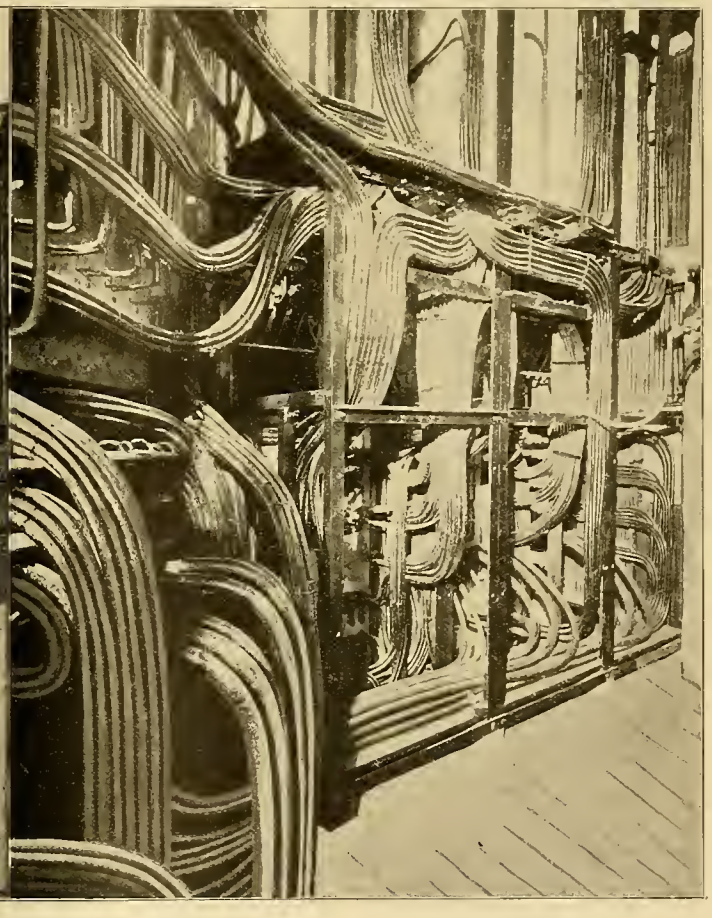


Fig. 2. Rear View of Theater Switchboard and Fuse-board.

ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.

they can be operated individually or combined and operated together. The house lights are controlled by three large dimmers. The floor pockets, orchestra and dressing-room lights and a 2,500 candle power front-protection arc light are controlled by double-throw switches, with one side connected independently of the main switches—a decided advantage for dark changes on the stage when it is necessary to have the rest of the circuits open. There are nine floor pockets, with three plug receptacles in each, arranged in three circuits, one for arc lights, one for incandescent lights controlled by dimmers and one for independent incandescents. The theater is equipped with six portable bunch stands of six and eight incandescent lamps each and three 2,000 candle power arc-lamp stands, which can be plugged into the floor pockets wherever required and the light directed on the stage. One of the incandescent stands is shown at the left of Fig. 1.

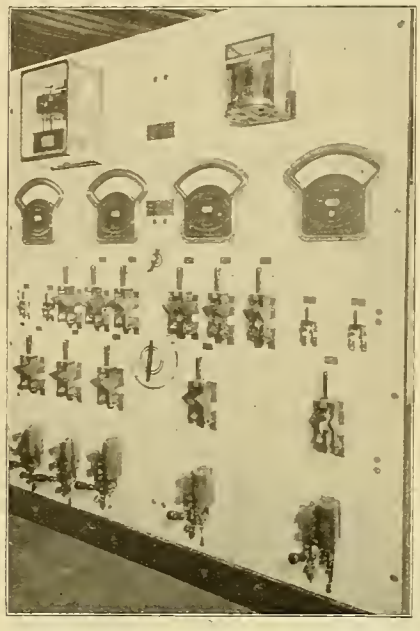


FIG. 3. ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.—DISTRIBUTING SWITCHBOARD.

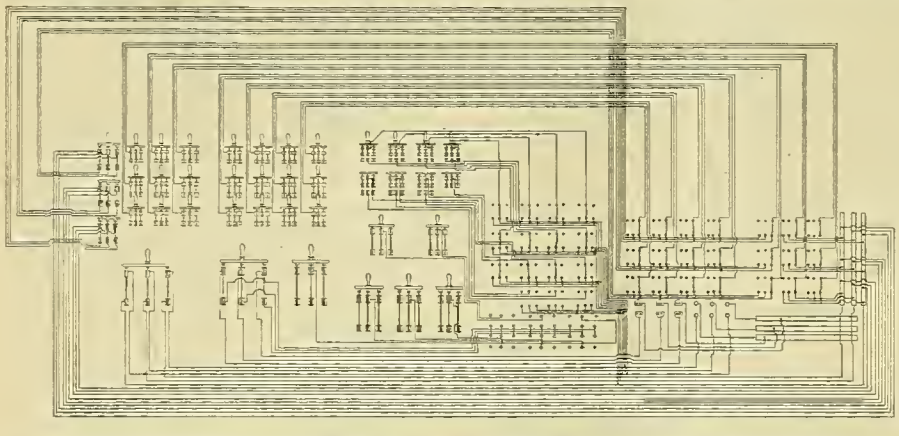


FIG. 4. ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.—WIRING DIAGRAM OF THEATER SWITCHBOARD AND FUSE-BOARD.

A telephone at the switchboard is connected with another at the front-projection light in the first balcony, by means of which the lamp operator can communicate with the electrician at the board. A telephone circuit also runs from one side of the stage to the other, so that the stage manager can speak with his assistant. The telephone instrument on the switchboard and one of the stage telephones can be seen in Fig. 1. There is also a local system of Stromberg-Carlson telephones connecting the different box offices and departments with the office of the director of the building. A call-bell system is provided for calling the people from their dressing-rooms at the proper time. The theater is one of the most lavishly lighted houses in the city for its size. There are 865 lamps in the auditorium of the hall, arranged in five-light bunches, and a total in the house, including the stage and dressing-room lamps, of 1,350. These lamps are of 16 candle power, but they are being gradually replaced by 10 candle power lamps, the illumination being found to be too brilliant. The white lights in the first border and in the footlights are 24 candle power lamps.

University Hall has a Tennessee-marble switchboard similar to the theater board. It contains switches for one set of borders and one of footlights with three colors for each. The lights are also controlled by dimmers, so that small theatrical entertainments may be given in the hall with all the effects of a large theater. The lighting of this house is a little out of the ordinary. On the side walls are six large clusters of 26 lights each, the design resembling a number of torches bunched together. Below these on piers are eight seven-light bunches, and on the front of the balcony is a row of lamps eight inches apart. This house contains a total of 577 incandescent lamps. The assembly hall is designed for small club meetings and dancing parties. It is lighted with six-light bunches set in plaster rosettes in the ceiling. The lecture hall and class rooms adjoining, used by the University of Chicago School for Teachers, are lighted by five-light bunches.

All of the halls are ventilated by fans driven by electric motors of the B. F. Sturtevant company's make. The ventilating system of Studebaker Hall has two 72-inch induction fans driven by a 20 horse power multipolar motor at a speed of 150 revolutions a minute, and discharging 50,000 cubic feet of air a minute. The eduction fan is 56 inches in diameter and is driven at a speed of 300 revolutions a minute by an eight horse power bipolar motor. By means of this system the air in the hall is changed eight times an hour. Two 56-inch induction fans driven by a 10 horse power multipolar motor at 300 revolutions, and a 36-inch induction fan driven by a 4½ horse power bipolar motor, operate the ventilating system in University Hall. These four motors are all in the basement, two of the fans located above the halls being driven by rope transmission. The assembly hall is ventilated by a 52-inch fan driven by a five horse power motor, and the lecture hall by a slow-speed fan driven by a three horse power motor.

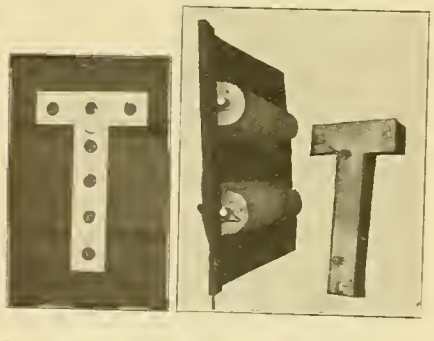


FIG. 7. ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.—FRONT AND BACK OF LETTER ON ENTRANCE SIGN.

There are six Standard electric elevators in the building, five passenger and one freight. Each is driven by a 15 horse power motor directly connected to the worm of the hoist. These machines are controlled by large electromagnets. When these magnets are energized by the operator's switch the brake is released and the main switch is thrown, thus starting the elevators. On each side of the controller switch there are two contacts, one to throw the magnet armature and the other to cut in or out the shunt field of the motor, which changes the speed as desired. These machines lift 2,000 pounds at a speed of 300 feet a minute. One of the elevators recently tested during a service of nine hours traveled 14 miles, using an average of 2.2 kilowatts of power for every car-mile traveled. The safety appliances of the elevators are very substantial and reliable. If the current is shut off the switch is released and the brake set by a weight. In case of a cable becoming slack or jumping out of place a catch is thrown which sets an automatic brake and stops the car. In Fig. 5 is shown one of the elevator machines.

Four 1,500 candle power Bergmann arc lamps are used in front of the building. A large electric sign, illustrated in Fig. 6, is mounted in the arch of the south entrance. On the top portion of the sign are placed letters reading: "The Studebaker. Castle Square Opera Co." This is a permanent fixture. Below are suspended one or two boards, with receptacles, upon which are placed letters indicating the name of the current attraction. By a simple yet ingenious device the letters can be placed on the board and removed quickly and with ease. The board consists of a tin-covered frame having two longitudinal slots running its entire length. Back of each slot is mounted a copper contact rod, the ends being connected to the house circuits. The individual letter (Fig. 7) consists of a tin box bearing the lamp sockets and two fuse plugs on its front. At the back are two contact clips which are adapted to slip over the rods in the board and hold the letter in place. Inside the letter the clips are connected to the various lamp sockets. Fig. 7 shows a single letter mounted on the board and the back of both board and letter. This form of sign letter and board is made by Tripp & Co. of Chicago.

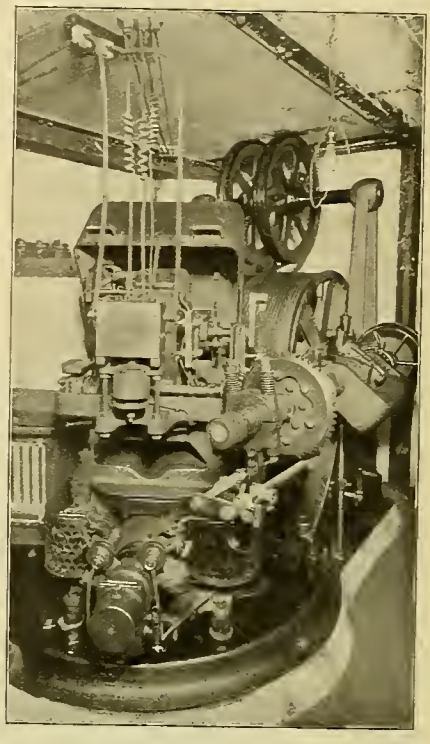


FIG. 5. ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.—ELEVATOR MECHANISM.

The Paul vacuum system of heating is used in the building, the circulation being obtained with but one-half pound of steam and a 15-inch vacuum. Pierce & Richardson were the designers of the plant and consulting engineers for the building, and the Western Electric company had the wiring contract. Mr. Whyte supervised the installation of the apparatus.

FIG. 6. ELECTRICAL FEATURES OF THE FINE ARTS BUILDING.—LAMP SIGN AT ENTRANCE.

A dispatch from Colorado Springs states that the great explosion at Vesuvius Butte, announced in the last issue of the Western Electrician, took place on December 18th, according to programme. A tunnel 100 feet long was run into the bluff, 30,000 pounds of dynamite was planted, and at 2 p. m. the explosion took place. Hundreds of invited guests, a mile or more away, witnessed the upheaval of the rock. The debris will be utilized in constructing a dam for the Pike's Peak Power company.

Invention of Combined Gas and Steam Engine Claimed.

[From the Canadian correspondent of the Western Electrician.]

The problem of the transformation of heat into mechanical energy in an economical manner has been a perplexing one since the advent of mechanical power. Professor V. H. Emerson, mechanical and civil engineer, an American citizen at present residing in Ottawa, Ont., who has established a reputation in Canada through his recent discovery of a process for the conversion of sawdust and saw-mill refuse into calcium carbide for the production of acetylene gas, claims to have taken very important steps in solving the problem, and he has in operation a powerful and compact machine which he terms a hydro-electric motor, inasmuch as the motor is composed of a number of elements, in which water and electricity form prominent parts. In respect to his new discovery, Professor Emerson, when questioned, said:

"I cannot go into the structural details concerning the motor, as I have not yet secured patents. I have designed the machine for operating my carbonizing machinery, of which I expect to install plants throughout the country. The motor may be used for many other purposes, such as operating street cars, boats, supplying electric light or pumping water for private residences, and as a motive power for vehicles; in fact, in any place where a powerful motor of light weight is required. A 10 horse power motor, as constructed for a carriage or boat, would not exceed 125 pounds in weight, and the two horse power machine I now have in operation weighs 46 pounds, but in this I have not attempted to reduce the weight. The motor operates at a moment's notice by connecting a lever with a key, which puts an electric battery in circuit, and it is as easily controlled as a steam engine; in fact, when once started, requires no further attention.

"The principle upon which my motor operates is equivalent to building a fire directly in a vessel of water; the water, taking up the entire heat, becomes expanded into steam, and thus produces mechanical energy by so doing. The hot gases escaping from the smokestack of a steam boiler or the high temperature of the exhaust of a gas engine is entirely obviated by my system of motor and it will exceed, in point of economy, more than 50 per cent. of the best steam-engine practice.

"In order that the operation may be more thoroughly understood, I may state that atmospheric air is charged with carbonaceous matter. This mixture is ignited by an electric current, producing expansion and a high temperature. At this instant it is brought into contact with water, broken into minute proportions, the water being converted into vapor instantaneously, which reduces the temperature and increases the pressure, which acts upon a piston and is converted into mechanical power. The whole operation is automatic and continuous, and we have practically a steam engine without a boiler or exhaust steam."

Milwaukee Railway Ordinance Passed.

After a stubborn parliamentary fight the ordinance extending the franchise of the Milwaukee Street Railway company, which has been causing no little discussion among the citizens, was passed in the Milwaukee Common Council on December 18th. The ordinance extends the franchise 10 years and compels the company to sell 25 tickets for $1 from 5:30 to 8 a. m. and from 5 to 7 p. m. The clause fixing the regular rate of fare was changed from "shall be five cents" to "not to exceed five cents." The ordinance will now go over until the next meeting of the council, when it will come up for final action. It is intimated that certain persons opposed to the ordinance will take it into the courts.

Chicago Union Traction Company.

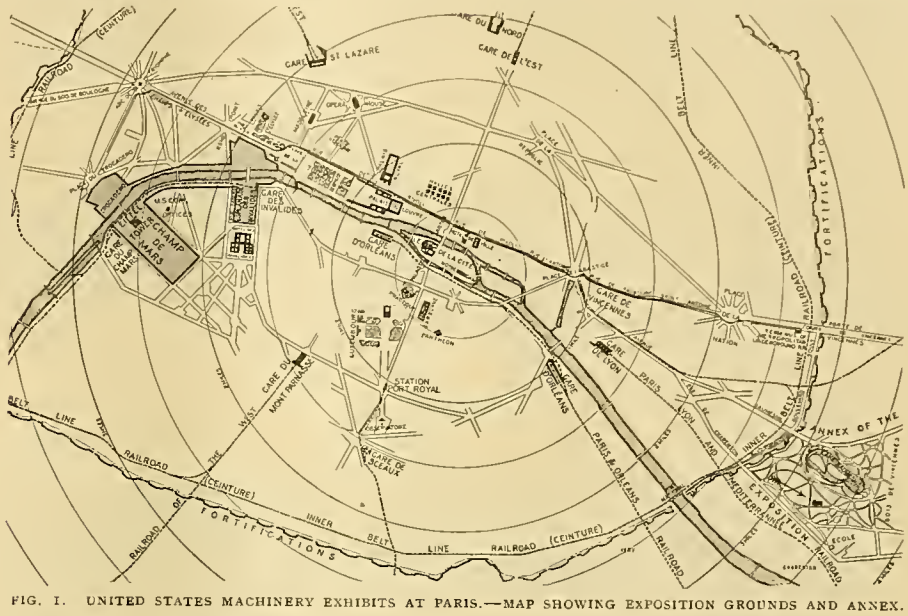
Four directors were added to the board of the Chicago Union Traction company last week, and Mr. Walter H. Wilson was elected to the newly created position of third vice-president. The officers and directors now stand as follows: President, Jesse Spalding, Chicago; first vice-president and general manager, J. M. Roach, Chicago; second-vice-president, R. A. C. Smith, New York; third vice-president, Walter H. Wilson, Chicago; treasurer, James H. Eckels, Chicago; directors, Jesse Spalding, Chicago; C. K. G. Billings, Chicago; C. L. Hutchinson, Chicago; Walter H. Wilson, Chicago; R. A. C. Smith, New York; W. L. Elkins, Philadelphia; P. A. B. Widener, Philadelphia; Walter T. Johnston, president of State Trust company, New York; H. B. Hollins, of H. B. Hollins & Co., New York; William Dickinson, Chicago; John V. Clarke, Chicago, president Hibernian National Bank. The last four names are those of the new directors.

The regular quarterly dividend of 1¼ per cent. on the preferred stock was declared payable January 20th. Books close 30 days prior to the date of payment.

According to the official figures submitted to the New York Stock Exchange, the earnings of the Chicago Union Traction company applicable to the stock were for the three months ended September 30th $285,873.78. This is equal to 2.71 per cent. on the common stock after paying five per cent. on the preferred stock. The application to list contains the announcement that the Chicago Union Traction company, through its leases of the North and West Chicago Street Railroad companies, controls a total mileage of 202.70 miles of double-track street railroad. The company is authorized to operate street railroads other than by steam power within the city of Chicago and the counties of Cook, Lake, McHenry, DuPage and Will, in the state of Illinois. On September 30th the company had over $425,000 in cash or cash items.

United States Machinery Exhibits at Paris.

According to the original plan, the exhibits of American tools and machinery at the Paris Exposition were to be arranged in groups in the main machinery building. But it was soon seen that the space allotted to the American manufacturers would be altogether too small to show properly the different types and patterns of tools and machines from the United States, and moreover, they could not be exhibited in actual operation; consequently, it was thought advisable to arrange for a separate building to be devoted exclusively to United States machinery exhibitors. The suggestion of such a building originated with Mr. F. E. Drake, director of machinery and electricity for the United States commission, and that gentleman will have oversight of the erection of the structure and the installing of the exhibits.


CARE DU NORD
CARE DE L'EST
CARE ST LAZARE
CARE DE VINCENNES
CARE DE MONTPARNASSE
CARE DE LYON
CARE DE LA RAPEE
CARE DE GRENELLE
CARE DE PASSY
CARE DE CHAMP DE MARS
CARE DE L'ALMA
CARE DE CLICHY
CARE DE ORLEANS
CARE DE SCEAUX
CARGO DES INVALIDES
U.S. COMM. OFFICES
STATION PONT ROYAL
PALAIS DE L'INDUSTRIE
PALAIS DES BEAUX ARTS
PALAIS DE L'ELYSEE
PALAIS DE LA LEGION D'HONNEUR
PALAIS DE LA CITE
PALAIS DE JUSTICE
PALAIS DU LOUVRE
PALAIS DU TROCADERO
PALAIS DU CHAMP DE MARS
PALAIS DU CONSEIL D'ETAT
PALAIS DU CONSEIL DES MINISTRES
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wide. Fig. 3 shows the north and south elevations, Fig. 4 the east and west elevations and Fig. 5 (page 367) a transverse section of the building.

At the northwest corner of the building will be located the power house. This will contain two Climax boilers of 250 horse power each and a 300 horse power Erie-Ball tandem-compound engine direct-connected to a 200-kilowatt, direct-current, 220-volt Bullock generator. The feed-water heater will be of the Wainwright type, and George F. Blake company's pumps will be used. In addition to the engine the boilers will supply steam to an Ingersoll-Sergeant air compressor, which will furnish compressed air to pneumatic tools in the building and will be also used to operate the mechanisms of the locomotives in the railway exhibit, some 2,000 feet distant.

Electricity will be used throughout the building for light and power. The smaller machines exhibited will be operated by short countershafts, while all the larger machines will be driven by individual motors. The different exhibitors will select their own type of motor. A three-motor, 30-ton electric crane, with a span of 33 feet and a clear lift of 21½ feet, built by the Shaw Electric Crane company, will traverse the main building. It is represented in the transverse section shown in Fig. 5.

The location of the building at Vincennes is indicated by the arrow on the map given in Fig. 1. This map is an outline plan of Paris, showing the main exposition grounds and the official annex at Vincennes. As shown by the half-mile circles radiating from the center of the city, the annex is between five and six miles from the main exposition grounds. At the annex, in addition to the United States machinery building, will be located the locomotive, automobile and bicycle exhibits, together with those of the life-saving station on the lake near by. In the building there will be 60 or more exhibits of machines and tools for metal and wood, some of the machinery being automatically operated. Another section will contain cotton-compressing, ginning and baling machinery, and in a third department will be exhibted a generous amount of mining machinery. It is intended to have the tools in constant operation, so that the actual performance of the machines under every-day conditions may be demonstrated to the visitor. It is probable that the product of the different machines will be sold, so that the expense entailed may be somewhat reduced.

The design, construction and erection of the skeleton of the building will serve as an exhibit of the Berlin Iron Bridge company, and much of the material, machinery and apparatus necessary to the completion and equipment of the building for the exhibitors will be contributed by the manufacturers as exhibits, the government paying for the transportation. At the end of the 10 months of the exposition the skeleton of the building will undoubtedly be sold to some manufacturing plant in Europe, although it may possibly be shipped to Russia and erected at either St. Petersburg or Moscow, at one of which places the proposed Russian exposition of 1901 will be located. In such an event it will probably serve as a United States exhibition building.

Collective Exhibit.

A very interesting and attractive portion of the United States display in its section of machinery and electricity on the main exposition grounds is to be a collective exhibit, occupying an area of about 1,500 square feet, where will be shown small mechanical and electrical appliances and devices, such as machine tools, instruments of precision, engine and boiler accessories, telephones, meters, switches, lamps, insulating material, house goods, etc.

The government will accept exhibits in this group at its warehouse in New York, assuming entire charge of them from that point until their final return to the exhibitor again at the same port. In this way the individual exhibitor will be relieved of the annoyance attendant on transportation, customs entry, storage of packing cases, installation, care of exhibits, explanation by competent attendants and judicious distribution of printed matter. Every service and every expense will be covered by a single charge, based on case, wall or floor space occupied. This will provide for the "flooring charge" of the French authorities, platforms, cases, counters, tables, hand-railings and light posts, wiring, special lighting of cases and exhibits, signs, labels, etc.

An engineer of ability, speaking French as well as English (and possibly German), will be secured, and with the aid of one or more assistants will install and care for the exhibits. Being in constant attendance, he can circulate the advertising literature for each firm and be in a position to present advantageously the exhibits to the jury of awards.

An exhibit of this kind will adequately represent each of the firms and be comparatively inexpensive; the entire sum paid in will be expended more efficiently, and the trouble and cost to the exhibitor will be reduced to a minimum. The advantages of this arrangement will be extended only to what may be considered desirable exhibits.

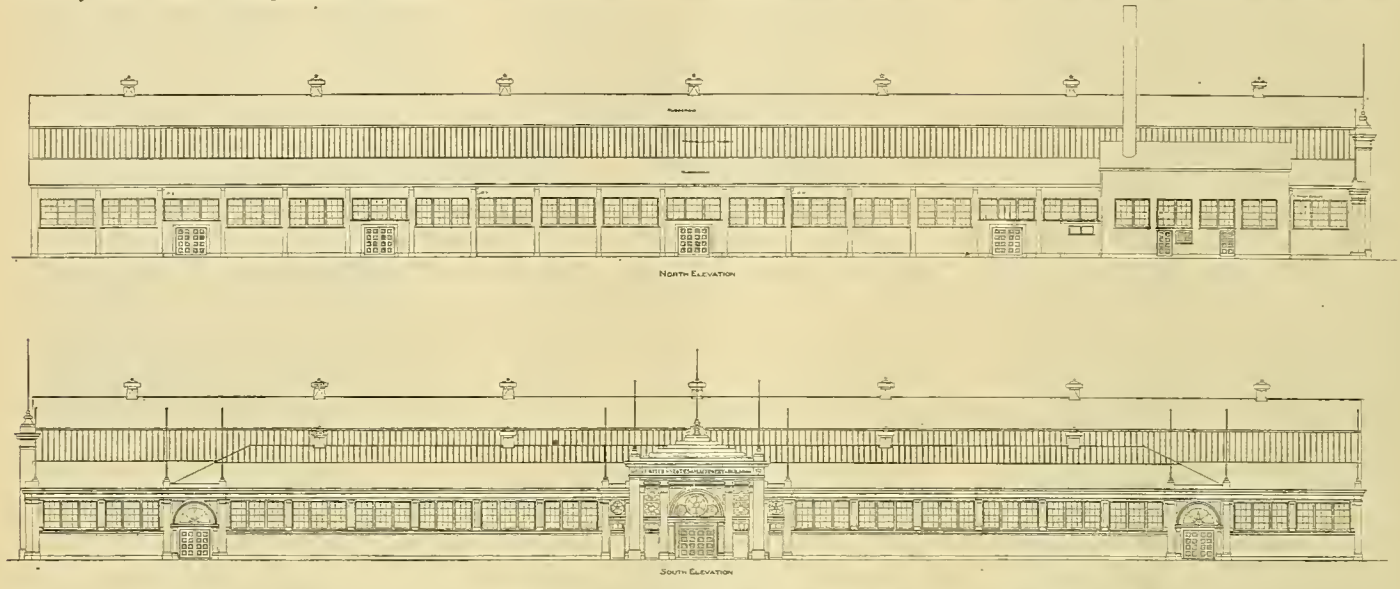


FIG. 3. UNITED STATES MACHINERY EXHIBITS AT PARIS.—ELEVATIONS OF MACHINERY BUILDING.

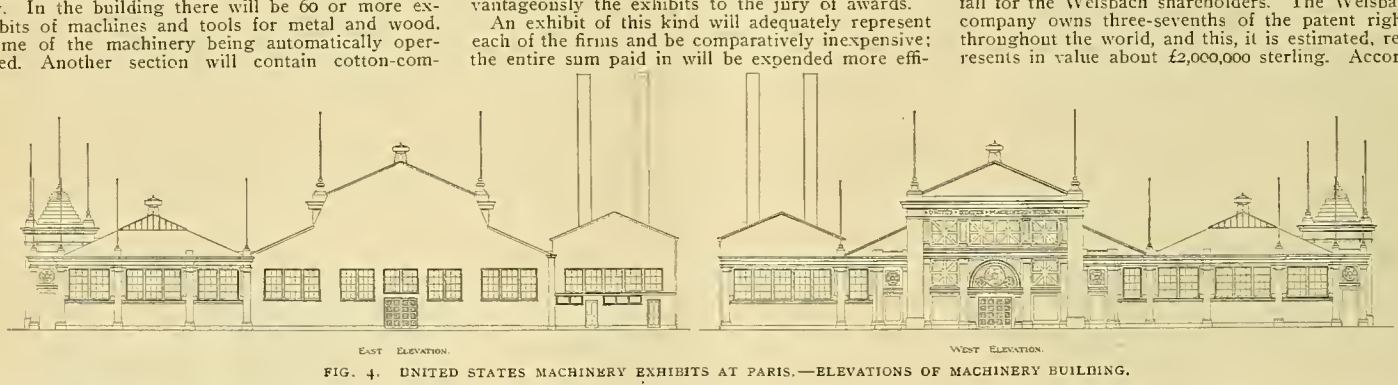


FIG. 4. UNITED STATES MACHINERY EXHIBITS AT PARIS.—ELEVATIONS OF MACHINERY BUILDING.

Electrical Features of Reciprocity Treaties.

The president has submitted to the Senate for its ratification the various reciprocity treaties that have been signed during the last summer, under which the following arrangements are made: In the treaty with Barbadoes, under date of June 16th, it is provided that machinery for electric lighting shall be admitted into that country free of duty, and the same provision is made in the treaties with British Guiana, Turks and Caicos Islands, while under the treaty with Jamaica it is provided that "apparatus and appliances of all kinds for generating, storing, conducting, converting into power or light and measuring electricity, including telegraphic, telephonic and electrical appliances of all kinds for communication and illumination, telephones and telephone switchboards," shall be admitted from the United States into Jamaica free of duty. The treaty with France provides for the extension of that country's minimum tariff to all articles shipped there from the United States, with the exception of dynamos, dynamo conductors and parts and arc lamps "known as regulators;" and no reductions are allowed on similar articles received in the United States from France.

Dr. Auer's Lamp to Work Wonders.

An English electrical journal publishes, without comment, the following high-flown paragraph credited to the Westminster Gazette of London: "We are able to make an important announcement as to the great Welsbach company. At the last meeting much was made of Dr. Auer's new incandescent electric lamp. It is claimed for this lamp, it may be remembered, that it will do for the electric light what the incandescent system has done for gas; that it cheapens the light by more than half; that the Welsbach incandescent electric lamp will give four times the light of the ordinary incandescent lamp. One new point is that the new lamp is now perfected, Dr. Auer having just gone to Berlin to give its manufacture his final supervision. New premises have been erected by Messrs. Pintsch for the manufacture of the lamp in all sizes, and it is expected that it will be ready for introduction into this country early in the new year. Another new point is as to the financing of this latest lamp. We are given to understand that, according to the arrangement between the Welsbach company and the inventor, it will by no means involve any new capital expenditure; on the contrary, it will mean a windfall for the Welsbach shareholders. The Welsbach company owns three-sevenths of the patent rights throughout the world, and this, it is estimated, represents in value about £2,000,000 sterling. According to present arrangements, the Welsbach company will not work its rights, but will immediately dispose of them, which, if half the hopes are realized, will, as we have said, mean a handsome windfall for the company and its shareholders."

If the foregoing statement about the efficiency of the Auer lamp means that "four times the light of the ordinary incandescent lamp" is given for the same amount of current, then it is indeed wonderful, if true. Of course, it means nothing without a standard of comparison. It may be remembered that a French lamp for which a somewhat similar claim is put forth was illustrated and briefly described in the Western Electrician of August 12th last. This was the incandescent lamp of Desaymar, said to be "to ordinary incandescent lamps what the Welsbach lamp is to an ordinary gas burner—a lamp which is claimed to give a considerably increased luminosity at a minimum cost." It was stated that an important establishment for the manufacture of the Desaymar lamps was being equipped at Rueil.

Pacific Cable Projects.

Two bills for the construction of a Pacific cable have been introduced in Congress—the one presented in the House by Representative Corliss of Michigan and referred to in the Western Electrician of last week, and what is known as the "naval bill," introduced in the Senate by Mr. Hale of New Hampshire. The latter calls for a $10,000,000 cable plant, including submarine lines, stations and equipment, to be laid by regular naval vessels, if necessary, and to be delivered when completed to the postmaster-general, who shall manage, operate and maintain the service. However, an appropriation of $11,000,000 is asked for, the extra $1,000,000 being for maintenance the first year, after which the Postoffice Department would care for expenses and receipts. The route is from the city of San Francisco, Cal., to the city of Honolulu, Hawaiian Islands, and thence by way of the Midway Islands and the island of Guam, or by whatever other route may be deemed by the secretary of the navy to be the most practicable, to the cities of Iloilo and Manila, in the Philippine Islands.

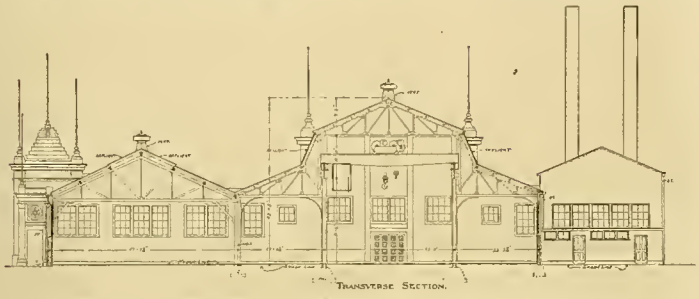


FIG. 5. UNITED STATES MACHINERY EXHIBITS AT PARIS.—MACHINERY BUILDING AT VINCENNES.

Section 5 of the "naval bill" for the establishment of the cable reads as follows: "That the secretary of the navy is hereby empowered immediately upon the passage of this act to cause to be prepared plans and specifications, to solicit proposals, by suitable advertisement, and to enter into contract or contracts for the construction, laying and equipment of said lines of telegraphic cable or portions thereof, at the earliest practicable date, such contracts to include the furnishing of all necessary materials, instruments, appliances and appurtenances and the performance of all work necessary to the laying and complete equipment and successful operation of said Pacific cables, except such materials and articles as can be more advantageously furnished and such work as can be more efficiently performed by the navy. Contracts for materials, articles or labor connected with the establishment of the Pacific cables shall be governed by provisions of existing law relating to public contracts; provided, that the wires, cables, insulators, batteries, instruments and all other materials and appurtenances shall be of such quality as to insure the satisfactory maintenance and efficient operation of said cables, and no inferior materials, instruments, batteries or other appliances or work shall be accepted or paid for under any contract made under the provisions of this act."

Everybody seems now to favor the construction of an American transpacific cable: the only question is whether it shall be built directly by the government or by a private company subsidized by the government.

COMMUNICATION.

Design of the Imperial Plant in St. Louis.

To the Editor of the Western Electrician:

We note that your editorial in to-day's issue regarding Mr. Humphrey's paper describing our plant credits the design to Mr. B. J. Arnold. This is an injustice to our consulting engineers, Messrs. Bryan & Humphrey, who have represented us from the inception of this enterprise, and who alone are responsible for the design and supervision of our entire plant.

Kindly give this correction prominent place in your next issue.

IMPERIAL ELECTRIC LIGHT, HEAT AND POWER CO.
E. G. Bruckman, General Manager and Secretary.
St. Louis, Mo., December 18, 1899.

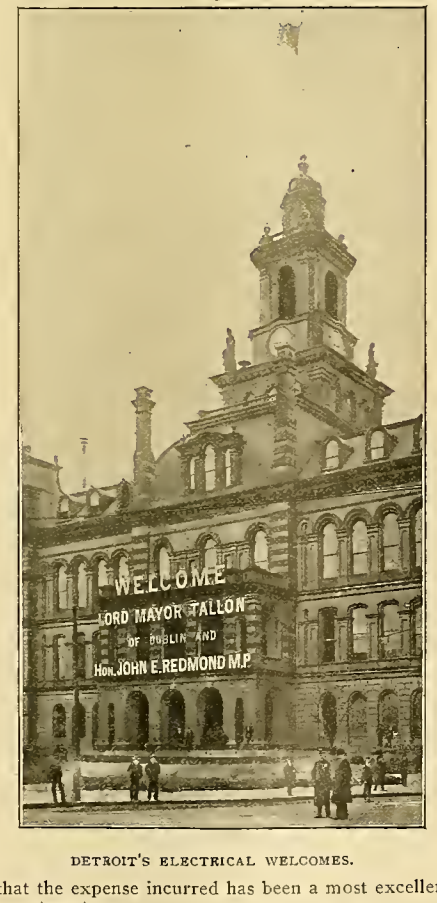
[As the Western Electrician understands the engineering situation in relation to the Imperial plant, the power station was built on plans submitted by Mr. B. J. Arnold, president of the Arnold Electric Power Station company, the contractor for the whole power-house equipment, and approved by Bryan & Humphrey, the consulting engineers of the Imperial company. Thus, the statement of the Western Electrician last week that Mr. Arnold designed the station is strictly true, and yet, in another sense, as Mr. Bruckman says, the consulting engineers are responsible for the design, having approved it. It may well be borne in mind, also, that the contracting company assumed the entire responsibility for the success or failure of the design, whoever was the engineer.—Ed.]

Detroit's Electrical Welcomes.

During the early part of the present year the city officials of Detroit, realizing that over 50 conventions (some of which were to be the largest held in the country) were to be held in Detroit in 1899, came to the conclusion that arrangements should be made for welcoming the visitors in such manner that they would feel that their presence in Detroit was noted, and that the city was glad to have them there. After considering several schemes, the one finally adopted was to arrange for placing on the front of the city hall electric signs, each of which was to have such lettering as would welcome in turn the different gatherings. Plans and specifications were therefore advertised for by the Board of Public Works, and the contract was awarded to the Michigan Electric company of Detroit.

Up to the present writing there have been over 60 different signs (each different from all others) exhibited in turn upon the front of the city hall. The total cost has been about $2,300, about 80 per cent. of which represents a permanent investment in adjustable frame and illuminated metal letters, the remainder being the cost of putting up and taking down the different signs. The city now has on hand four-foot letters to form the word "Welcome" and a stock of 75 three-foot and 52 two-foot letters, from which the various signs are made, these letters having become, under terms of the contract, the absolute property of the city. For another year, it will be seen that no expense will have to be incurred, aside from the cost of current, except the labor in erecting and taking down these signs, and, occasionally, an extra letter or two, when signs are required calling for a greater number of certain letters than are now in stock.

There has been a great deal of favorable comment on these signs, due to the fact that Detroit is the first city in the country to welcome each individual convention, and the city officials feel that the expense incurred has been a most excellent investment.



DETROIT'S ELECTRICAL WELCOMES.

As showing the general character of the adjustable frame and signs, the photograph reproduced herewith, showing the sign, "Welcome Lord Mayor Tallon of Dublin and Hon. John E. Redmond, M. P.," is all that is needed. In front of each of the stone columns is a vertical three-inch pipe standard, and attached to these uprights, in an adjustable manner, are 1½-inch horizontal pipes, on which the lamp-studded letters are supported. The number and position of these pipes are adjustable by the use of adjustable crosses which slide up and down on the vertical standards.

The majority of the signs shown have consisted of the standard letters (as shown in the photograph before referred to), but in some instances (notably the Christian Endeavor and Odd Fellows' conventions) special designs have been used. The Christian Endeavor design, "C. E.," was about 18 feet in diameter and weighed nearly 2,000 pounds. The "C" was in red, fitted with red lamps, the "E" in white, with frosted lamps. In the case of the Odd Fellows' sign, the "Welcome" and "I. O. O. F." were formed of standard metal letters, fitted with frosted lamps. Of the three links, those on the sides were in red, with red lamps, the center link was of white, with frosted lamps. The letters within the links were in blue, with blue lamps. The borders around the "Welcome" and "I. O. O. F." were red, with red lamps, and the chains, which apparently supported the links, were in gold, with amber-colored lamps. The length of the adjustable frame is about 55 feet.

Sixty organizations have been welcomed, including people from every section of the United States and in some instances, as in the great Christian Endeavor gathering, from the ends of the world.

Secretary R. Y. Ogg of the Detroit Board of Public Works had the special Tallon decorations in charge.

Trademarks.

In discussing the importance of trademarks, Mr. Duell, the United States commissioner of patents, says:

Every manufacturer should adopt and use trademarks, not only for his domestic, but for his foreign trade. When a mark is selected care should be taken that it is a lawful trademark and one to which the right is unquestionable. It is never a wise practice to adopt the manufacturer's own name as a sole mark; everyone has the right to use his own name upon his own goods, but there might be any number of men using the same name, and either one would have an equal right to do so; nor is it wise to use a geographical term, for the United States Supreme Court has repeatedly held that no man can exclusively appropriate to his own benefit a geographical term so as to prevent others inhabiting the same or similar territory from dealing in similar articles. It is true that the decisions of the courts have not been uniform on this subject, but in every case, with possibly one or two exceptions, where the exclusive right to use a geographical term has been sustained, some peculiar facts have led to such decision; therefore, if a manufacturer desires to keep out of litigation it would be well for him to avoid selecting a geographical name for a trademark.

Don't adopt a descriptive word or name. It has been held by the courts, times without number, that words or names simply indicating the quality or the ingredients of the articles cannot be appropriated so as to prevent others from employing the same words upon the same articles.

Don't adopt a word expressing quality, great or peculiar excellence. No man has the exclusive right to use any word or symbol which merely indicates the excellence of his article. No more has he the right to exclusively appropriate for his own products marks, letters, numbers or words which actually indicate the grade of the article.

It is so easy to select a device or symbol or to coin a word that there is no reason why a manufacturer or merchant should select as his trademark anything which is not a lawful trademark, or which is on the border line and will in all probability ultimately land him in the courts.

Through labor-saving inventions we are able to produce manufactured articles as cheaply as they are produced in many other countries where wages are much lower. If, then, our manufacturers send out only such of our manufactured products as suit the tastes and requirements of the people to whom they sell, we cannot fail to greatly extend our export trade in manufactured articles; and, when once established, if we have adopted and used lawful trademarks, to indicate our ownership and title, there will be no reason why the trade, once gained, cannot be kept indefinitely.

Feats of Telegraphers.

Since the publication in the Chicago Journal of the fact that Fred J. Case, a Western Union operator, has sent 80 messages in 60 minutes, and that his friends claimed this was the best record for Chicago, telegraph operators have arisen with declarations of higher speed than this.

As many as 102 messages in one hour is claimed for one man. J. W. Pettit, chief operator of the Postal Telegraph Cable company, says: "On June 21, 1899, S. B. Runyon, working our wire connecting the Chicago and New York boards of trade, sent 328 messages in an even four hours, an average of 82 messages per hour. This is extraordinary for the reason that it is a sustained effort of four straight hours. Again: November 19, 1892, E. S. Williams, now chief operator at the Board of Trade office in Chicago for the Postal Telegraph Cable company, received 326 messages in three hours and 50 minutes, an average of one message every 42.3 seconds, or 85 messages per hour. These messages were transmitted over the line from Minneapolis by Miss Cleo Harris. On October 15, 1897, T. A. Balassa, working our New York exchange wire, sent to John Scanlan at the New York office 102 messages in one hour. On October 27, 1897, the same operator handled over the same wire 364 messages in three hours and 40 minutes, an average of 99 messages per hour."

Western Electrician

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new, should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The next date of exceptional interest to the electrical fraternity hereabouts is that of the annual meeting of the Northwestern Electrical association, which will be held in Milwaukee, as usual, on January 17th and 18th. Headquarters will be at the Hotel Pfister, and about 150 members and visitors are expected. Mr. Doherty, the president, and Mr. Mercein, the secretary of the association, are preparing for a gathering of real interest and usefulness, and there is no doubt that their expectations will be realized.

In London when a central-station manager is haled into court for maintaining a smoke nuisance, he can plead the South African war. At least that was what was actually done at Westminster early in the month. Mr. Iago, the secretary of the Westminster Electric Supply corporation, appeared to answer two summonses under the public-health act for negligently using furnaces so that smoke therefrom was not effectually consumed. The offenses were not denied, and Mr. Iago, in palliation, urged that the government had acquired for its transports all the available stock of Welsh smokeless coal. However, the prosecuting attorney suggested that a more rapid consumption of the coal by thorough draught, although not economical, might prevent the complaints. A fine of $100 was imposed, so that the excuse of war-time necessity did not prove very effectual.

It is rather curious that so many non-electrical magazines are publishing just at this time illustrated articles on the interesting effects that may be obtained by the disruptive discharge of the high-potential current of a spark coil on a glass photographic plate treated as a condenser. The pictures obtained—photographs without a camera—are very interesting and often show beautiful forms, but they are not especially new. The results are curious rather than novel. A number of pictures thus secured were reproduced in the Western Electrician of February 25, 1899, in an article entitled "Effect of Electrical Discharges on Photographic Plates," and they bear a strong family resemblance to the "electrographs" and "feather-like" pictures now to be seen in several popular publications. The phenomena have been recognized and described for several years—at least from the beginnings of skiagraphy, if not before.

Considered merely as an advertisement of the country, the money laid out on the recent International Commercial Congress at Philadelphia was a wise expenditure. The city of Philadelphia is reported to have spent $100,000 in entertaining the guests, but as the affair was ably conducted and an entire success, it cannot be doubted that the money disbursed in a pleasant exercise of hospitality will prove a judicious investment as well. It is said that large orders were placed by foreign delegates for American goods, but of course the indirect and future benefits to the foreign trade of the United States should be much greater. At least one foreign nation recognizes the value of the idea and has paid it the tribute of imitation, for it is stated that, with government assistance, a commercial museum for Germany is to be established. This museum is to have a central bureau at Berlin, with branches in Hamburg, Stuttgart and other cities. It is not admitted that the German museum is a copy of the one at Philadelphia, but there seems to be no doubt that such is the case. The Philadelphia Commercial Museum has accomplished a good work and deserves the hearty support of American manufacturers.

Daily newspapers may thank the Independent telephone movement for affording them a source of considerable advertising revenue as well as much interesting "copy." Before there was competition in the telephone business the service was no more advertised—that is, specifically called to the attention of the general public—than the telegraph is to-day. But now both the Bell people and the Independents buy space liberally in the advertising columns of the daily press and other mediums to set their claims before the consumers. Frequently a new company will take a page or a half page in the local papers to announce its plans; and it is necessary for both sides to give wide publicity to cheaper rates, better service and improved accommodations. When the competition becomes lively the advertisements bristle with charges and counter-charges and are sometimes very brightly written. The newspapers are the gainers by all this, but after all theirs is but a small proportion of the tremendous benefits conferred upon the country in the last five years by the men who have courageously entered the Independent telephone field. Actuated by motives of self-interest, of course, these men have nevertheless conferred on the people of the United States better and cheaper telephone service than the monopoly had need to offer.

A short time since the Western Electrician pointed out the possibility of openings for young Americans of technical training in the manufacturing and operating establishments of an electrical nature springing up in Great Britain. A recent paragraph in an English trade journal tends to confirm this view. In connection with the establishment of Westinghouse works at Manchester it is stated that the British company recently incorporated for that purpose has made arrangements for sending a number of young Englishmen to acquire a complete knowledge of the methods adopted by the Westinghouse companies at Pittsburg, and of the plant and equipment of which they make use. These young men, for the most part, have already acquired a theoretical knowledge of the electrical work, and their American experience will, it is proposed, be limited to about 12 months of good, practical work. On their return to Europe they will be placed in situations of trust in the British works of the company. The British Westinghouse company seems to desire specifically Englishmen trained in Westinghouse ways, but the need of the American training seems to give a hint that may be useful to graduates of American shops and schools. However, the young American engineer or electrician should bear in mind that men of practical experience are preferably wanted and that the environment and immediate remuneration to be obtained abroad are likely to be different from what he has been led to expect at home.

By the simple expedient of taking money out of one pocket to put it in another the aldermen of Negaunee, Mich., think that they have put their cherished municipal electric-light plant on a self-supporting basis. The city now pays itself $90 a year for each arc lamp—an increase of a trifle of 50 per cent. over the price which it started out to pay when it established its plant. Of course, this is simply robbing Peter to pay Paul; the city really makes an appropriation to cover a deficiency in one of its departments. The expert investigation conducted some time ago by a disinterested Chicago engineer revealed the fact that the accounts of the municipal lighting and waterworks plants were badly mixed and that the former was running behind. After cogitating on the situation for a few months the aldermen concluded to charge up what more nearly approximates a fair market price for the light and thus provide for the cost of operation, interest on the original investment, depreciation of the machinery, loss of taxes and other expenses. It is now calculated that this has been done; but the whole proceeding is an amusing example of the mistaken assumption of many municipal-ownership advocates that there are enormous profits in the electric-lighting business which can be saved to the municipality by throwing the central-station company out of business.

It goes without saying that if precautions for the safe operation of passenger trains are to be taken anywhere they should be at track crossings at grade. A distressing accident that happened a couple of weeks ago on Thirty-first street in Chicago serves as another reminder of the need of extreme care at these points of danger. There is a grade crossing of the tracks used by the Wabash steam railroad and a Chicago City crosstown line on this street. A trolley car was making the crossing when it was struck and demolished by a passenger train on the steam railroad. The motorman received such severe injuries that he died a few hours later, while 10 passengers were more or less seriously injured. There was the usual conflict of testimony in placing the blame for the accident, but the coroner's jury, after listening to the evidence, censured the steam railroad company and discharged the conductor of the trolley car. It was charged that the trolley wheel slipped off the wire while the car was making the crossing, but the finding of the coroner's jury seems to disprove this assertion. And the further fact that the brave motorman stuck to his post would apparently indicate that the car was in circuit and that he was doing his utmost to get it across the tracks in time. Fortunately, casualties like this are becoming more infrequent in Chicago, as the grade crossings are gradually abolished. The operating companies—both steam and street-railway—make every effort to insure safety at these points, but occasional accidents in which human lives are lost and limbs are broken emphasize the self-evident fact that railroad crossings at grade are a constant menace, even with the best care and ingenuity that men can bestow. When the last grade crossing shall have become a thing of the past a great and beneficent improvement will have been accomplished in the street-railway transportation of Chicago.

Three-phase Electric Railway in Switzerland.

An electric railway running between Burgdorf and Thun, Switzerland, is operated entirely by three-phase alternating current, generated by water power. The road, which is owned by the Burgdorf-Thun Electric Railway company, is 40 kilometers (24.8 miles) in length and connects at each terminus and at intermediate points with steam railroads. The power station, says Charles Rochat in an article in the Street Railway Journal, is located at Spies, on the Kander River, and contains four groups of turbine generators. The turbines operate under a head of 63 meters (200 feet) and the maximum horse power obtainable is 6,300. Alternating current is generated at 4,000 volts and is raised to the transmission voltage of 16,000 volts by static transformers. The current is carried to 14 transformer stations situated at nearly equal intervals along the road, by means of three copper wires of five millimeters (0.2 inch) diameter, carried on porcelain double-petticoated insulators, mounted on wooden poles. The transformers, which are oil-insulated and have a capacity of 450 kilowatts each, are placed at the side of the track and are enclosed in metal housings with wooden shutters supported on concrete bases. On account of the use of the three-phase system two trolley wires are used, the rails, which are bonded, acting as the third conductor. The voltage of the current, as received from the transformers, is 750 volts.

Electric locomotives and motor cars are used, the locomotives being principally employed for freight traffic. Each locomotive is equipped with two induction motors of 150 horse power each, running at 300 revolutions a minute at a voltage of 750. The rotors of the two motors are keyed to one shaft, from which the axles are geared. By means of two trains of gearing two different speeds may be obtained. Each locomotive carries a transformer for reducing the voltage from 750 volts to 100 volts. Part of this low-tension current is used for operating a three horse power motor compressor for the air-brake system, and part for lighting the car, the current for light being taken from two phases and the compressor motor being connected across all these phases. This low voltage was preferred because it was hardly possible to build so small a motor for 750 volts and it was thought advisable not to introduce the higher voltage into all parts of the cars and locomotives. Ammeters for the motor circuits and a voltmeter for the 750-volt circuit are provided in each locomotive. Electric headlights, made up of three lamps, are used.

The motor cars are of the double-truck type and are equipped with four 55 horse power motors, one for each axle. The electrical equipment of the motor cars is similar to that of the locomotives, except that electric heaters are also connected with the 100-volt circuits. Two sliding-contact bows at each end of the car serve as trolley poles. The motor cars have a seating capacity for 68 passengers, and are divided into four compartments, two for second-class and two for third-class passengers. The trail cars consist of two-axle cars for second and third-class traffic, carrying 45 passengers; two-axle third-class cars carrying 40 passengers and two-axle combination passenger, postal and baggage cars, carrying 20 passengers.

As the cars are operated on the three-phase system, a constant speed of 36 kilometers (22 miles) an hour is maintained. The cars can be braked quickly and stop in from three-fourths of a minute to one minute. The train service is conducted by ordinary steam-railroad methods and on the block system. A telegraph system connects the stations, the wires being carried on the same poles as the trolley wires.

Light Railways in Belgium.

Since 1884 the Belgian government has subscribed about $20,000,000 toward the cost of the vicinal or neighborhood railways. The lines are constructed by the Société Nationale des Chemins de Fer Vicinaux, founded in 1884. Over 1,021 miles are now in operation in 76 lines. Eighteen other lines, when complete, will bring up the mileage to 1,371 miles, if three new concessions are included. Eighty-five new projects are under consideration, which will probably give another 43 miles. These lines are not all. There are other lines, owned by various companies, aggregating 43 miles, bringing the total to 1,414 miles, as compared with the main-line railways, which aggregate 2,858 miles. The ratio is thus about 50 per cent. The vicinal lines are laid to the meter gauge, except where there appears a prospect of them being worked in connection with the main lines, or they are actually so worked, when the broader gauge of four feet 8½ inches is adopted. If likely to be connected with the lines in Holland, the gauge is (three feet 5.66 inches) 1.067 meters. The mean cost of rolling stock has been about $3,000 per mile. Locomotives weigh in most cases 18½ tons. Their total number is 321, or about one to each three miles of principal way. One line is worked by horses and one by electricity, while others are now being prepared for electric working. The working expenses are 67.2 per cent. of the gross receipts, and last year the train mileage was nearly 5,000,000. Out of 69 lines that have been worked for more than one financial year, not one has shown a loss; 31 pay over the guaranteed dividend.

A. B. Kerlin has been granted a franchise for an electric-lighting plant at Verndale, Minn.

The Biograph in South African War.

The following, from the London Daily Mail, shows that an effort is making by Mr. Dickson, formerly of Mr. Edison's laboratory at Orange, N. J., to obtain "moving pictures" of battles and other scenes in the war now in progress in South Africa. Incidentally, the light-hearted references to the discomfiture of the Boers and the hoisting of the Union Jack at Pretoria contrast painfully with the actual progress of events.

Will the "biograph man" succeed in "snapshotting" the war, or any part of it? That is what thousands of people have been asking each other since they read that General Buller had embarked on the Dunottar Castle for the Cape, and that W. K. L. Dickson, of the Biograph and Mutoscope syndicate, was on board the same vessel.

Well, the probability is that Mr. Dickson will succeed in photographing a great deal of the war, and the latest news received from him, a few days ago, is that he has landed his apparatus safely at Durban, and is anxiously awaiting a move toward the front. Already he has sent home a batch of pictures for the biograph at the Palace Theater and the mutoscope machines all over the country.

On the voyage out Sir Redvers Buller took considerable interest in the biograph's intending march on Pretoria, and, besides giving Mr. Dickson leave to get there whichever way he could—either by De Aar or through Durban and Ladysmith—discussed the possibilities of taking battle scenes, and gave some useful hints as to the way in which the biograph could get hold of a skirmish. In particular, the general thought that artillery actions would offer Mr. Dickson the best opportunities for getting effective war pictures, and the probability is that artillery fights will figure largely in the biograph's war album.

Of course, the difficulty of "biographing" war in these days, as Mr. Smedley, the managing director of the biograph enterprise, pointed out to a Daily Mail representative, is that, as a rule, your enemy is a mile or two away, and it is almost impossible to photograph both sides at once. The camera which Mr. Dickson has with him has telephoto lenses, which will photograph a couple of miles off, but even with that advantage, it is not easy to get an effective battle scene. And as the biograph machine, with its necessary batteries, weighs nearly three-quarters of a ton, Mr. Dickson will have to be both agile and energetic if he is to scuttle over the field of battle and fix up his apparatus in time to catch sight of the Boers as they disappear before a whirlwind of British cavalry or an onslaught of bayonets.

The biograph syndicate has confidence in Mr. Dickson's ability to "get there" whenever there is a chance, and its only direction to him was to get to Pretoria and "take" the hoisting of the Union Jack. He has taken between seven and eight miles of films, and as every facility will be given to him within the British lines, there is little doubt he will add another notch to his long list of successes.

As soon as Mr. Dickson has "snapshotted" a war scene he will dispatch it to London, where the films will probably be printed, developed, fixed and shown at the Palace Theater the day after they arrive.

Very Sensitive Receiver for Space Telegraphy.

A press dispatch from Pittsburg states that researches by Prof. Reginald A. Fessenden and his assistant, Professor Kintner, in the electrical laboratory of the Western University of Pennsylvania, have resulted in the production of a receiver for space telegraphy which is 2,000 times more sensitive than the coherer of the Marconi system. In speaking of the discovery, Professor Fessenden is quoted as follows: "Although we have improved the receiver so it is 2,000 times as sensitive as the original one, we realize we have not yet begun to see the limit. Marconi, in his brilliant experiments, has demonstrated that messages can be sent over 90 miles. As our receiver is several hundred times more sensitive, it is clear the messages can be sent by our method much further, though just what the limit is I would not like to say. It should be possible to send messages across the Atlantic with poles less than 200 feet high. The ultimate distance must be checked by actual experiment before it becomes a scientific fact in the strictest sense."

Northwestern Elevated Railroad.

An effort is being made to complete the superstructure of the Northwestern elevated railroad of Chicago, and to put the road in operation by January 1st. According to the ordinance under which the elevated road is being constructed, unless the structure is completed and trains operated by the beginning of the new year the company must forfeit $100,000 to the city. Several gangs of men are working on the construction and the work is being pushed forward rapidly day and night, but it is asserted by city officials that the permanent structure cannot be completed within the specified time. Should the officials of the road desire to obtain a further extension of time, it will be necessary to call a special meeting of the City Council, as that body now stands adjourned to January 3d.

Street Lighting by Arches.

As a result of the public spirit and enterprise of the Business Men's association of the city of Flint, Mich., eight electric arches span the street intersections and illuminate the business district from the courthouse to the river. The unusual system of public lighting was evolved from that in vogue at Columbus, O. The arches are of iron grillwork. Each is equipped with 50 incandescent lamps.

The People's Electric Light and Power company furnishes the corporation public lighting at $70 an arc lamp a year, the lamps to be operated on a moonlight schedule. There are upward of 125 arc lamps in use at this rate. The company is considering the question of its purchase by the city.

The recent dedication of the electric arches, which were erected and paid for by popular subscription and formally tendered to the use of the city, was attended by a celebration. Ten thousand people gathered in the street to witness the dedication. Colored fire was burned at different points on the street. The blare of tin horns was deafening. The formal transfer to the city was made under the Labor arch, erected by the Central Labor Union. A brass band played the dedication overture. The band, pursued by a big "tin-horn brigade," played a selection under each arch. Across the bridge some wag had erected temporary arches, from which were suspended Chinese lanterns. The band marched over and good-naturedly played under these, too, the same as though they were a part of the regular electrical outfit. The celebration closed with a rally around a big bonfire.

A 2,000 Horse Power Steam Turbine.

During his presidential address to the American Society of Mechanical Engineers in New York early in the month Rear-admiral George W. Melville spoke thus of the steam turbine: "At the present time it seems as though we had practically reached the highest development possible with existing types of machinery for naval purposes, leaving the designer room only for greater perfection in details. We do not, of course, believe that finality has actually been reached, and it is possible that some radical change may take place which will give us a new type of machinery. Some of the more enthusiastic members of the profession think that the steam turbine is to be the successor of the present steam engine, and assuredly the performance of Parsons' Turbinia is sufficiently remarkable to justify the most careful study and further experiment. It is very interesting in this connection to know that in this country the development of the steam turbine is in the hands of one of our famous engineers, who is also one of the honorary members of this society—Mr. George Westinghouse. He has been developing the steam turbine with special reference to its use in driving electrical generators, and some of the results already obtained are very remarkable. With his characteristic energy and courage, he is not satisfied with results on a small scale, but is now getting out a steam turbine to develop about 2,000 horse power on a single shaft, and when this has been built and thoroughly tested we shall be in a position to appreciate more thoroughly the bearing of this form of prime mover on naval engineering."

Chicago to Negotiate for Drainage Canal Water Power.

At the regular session of the City Council of Chicago on December 18th a resolution was unanimously passed authorizing the special committee of the council on water power to negotiate a lease for a term of years with the trustees of the sanitary district for water power expected to be developed by the Chicago drainage canal. The rental is to be made on a basis of a price of $5 a horse power per annum, the city to pay the cost of developing. The agreement is not to be binding until it has been ratified by the council. This action was based on the report of the special committee, which set forth that at an expenditure of $3,000,000 and a rental of $5 a horse power a year the city could produce electricity by water power at a cost of $15 a horse power a year throughout the 24 hours of the day. It was pointed out that the cost of producing electricity by steam was about $35 per horse power for a day of only 10½ hours throughout the year. The committee found that power could be generated at less than 20 per cent. of its present cost sufficient to pump the water supply of Chicago and light every important street intersection of the city.

Canadian Enterprise in Brazil.

Mr. B. F. Pearson of Montreal has just returned from São Paulo, Brazil, where a company of Toronto and Montreal capitalists is putting in a street-railway and electric-lighting plant. The city of São Paulo has a population of 75,000, and there was already a small electric-lighting plant (which the Canadian company has acquired) and an insignificant mule street railway is also in operation. The Canadians have 1,000 men employed rushing the work, and will probably have their line in operation by February next. They are well advanced with the work on the big dam, which will develop 10,000 horse power, to work both electric-lighting and trolley plant. The lighting is to be done on a large scale, and the street-railway system will be very complete, 40 miles being put down, going to all parts of the city.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northern Minnesota Telephone company has been given permission to make toll-line connection with Long Prairie, Minn.

The Southeastern Pierce County Telephone company has completed a line between Brasington and Ellsworth, Wis.

The Cannon Valley Telephone company has just placed in position at Waterville, Minn., a 100-drop switchboard.

The Northwestern Telephone Exchange company is rebuilding its system in Hudson, Wis.

The Mississippi Valley Telephone company is pushing work on its system in Minneapolis. Arrangements have been made for a sub-exchange on the North Side. A building has been leased and will be fitted with a switchboard to accommodate all the North Side and northeast subscribers. It is hoped to have the exchange running by February 1st.

The Citizens' Telephone company of Faribault, Minn., is securing a number of new subscribers since securing a connection with Minneapolis.

The Greene and Western Telephone company has extended a toll line from Waterville, Minn., to Montgomery.

The Northwestern Telephone Exchange company has completed connection from Fosston, Minn., to Crookston.

The Menominee (Mich.) Telephone company is making a spurt for new subscribers and expects to have 1,000 instruments in use within a few weeks. There are now 258 instruments connected.

The Wisconsin Telephone company has completed a toll line from Ashland to West Superior.

The Walworth County Telephone company has completed an exchange in Delavan, Wis.

A movement is on foot at Pittsville, Wis., to induce the Wood County Telephone company to put in an exchange there.

The Wisconsin Telephone company has asked permission at La Crosse, Wis., to construct three miles of subways for its wires. The council may require all wires to go underground.

The exchange at Sturgeon Bay, Wis., has 110 instruments connected.

The Belle Plaine (Ia.) Telephone company has been incorporated with $9,000 capital stock.

The Mutual Telephone company of Indianola, Ia., has changed hands. C. C. Reynolds, T. D. Swan, Dr. W. N. Park and E. B. Dowell have sold their interests and the ownership now rests with J. F. Hendrickson, Dr. E. Porterfield and John F. Schee.

Funds have been subscribed at Rolfe, Ia., to establish a telephone exchange.

The Rocky Mountain Bell Telephone company will enlarge its capital stock and will make a number of extensions and improvements. A line will be extended to Denver. Exchanges will be opened at Evanston, Green River, Rock Springs and Rawlins, Wyo. A toll line will be built from Rawlins to Laramie, Wyo. New exchange buildings will be erected in Missoula and Great Falls, Mont. A new switchboard will be put in at Boise, Idaho. The system at Butte, Mont., will be rebuilt.

The Ida Grove (Ia.) Telephone company has its new exchange in operation.

A telephone line has been completed from Charlton, Ia., to Norwood.

The Nebraska Telephone company has inaugurated a through telephone service from Avoca, Ia., to Council Bluffs and Omaha.

A telephone line is being built from Marathon, Ia., to Webb.

The Northern Telephone company has completed a line from Fonda, Ia., to the new town of Varina.

The Jefferson (Ia.) Telephone company has installed a new switchboard.

The chief of the Fire Department of Des Moines, Ia., wants a telephone fire-alarm system connecting the 24 fire stations in the city. He could thus report a fire to all and save time.

The Cedar Valley Telephone company of Waterloo, Ia., contemplates running a wire to Whitten, Iowa.

A telephone line will be built between Danbury and Smithland.

The Central Union Telephone company of Rock Island, Ill., has let the contract for the erection of an exchange building to cost $10,000.

The telephone company of Spokane, Wash., has moved its exchange to new quarters. There are nearly 2,500 subscribers in Spokane.

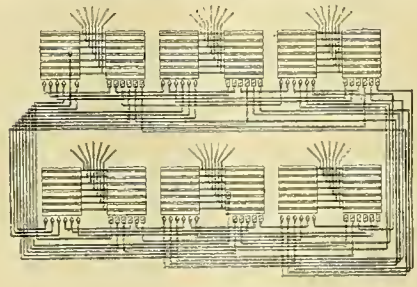
The Michigan Telephone company will place some of its wires at Marquette, Mich., underground.

Tree Cutting by Linemen.

The question of the amount of damage, if any, done by linemen in cutting the branches of trees for the passage of electric wires is up in Missouri, the wires in this case being those of a telephone proprietor, John Bevan, who owns a line between New Cambria and Ethel. The plaintiffs, Goodson and Wright, own and control property near New Cambria. The line follows the public road along plaintiffs' premises. Just inside the inclosure were two large shade trees. The contractors who erected the line found it necessary to cut portions of the trees to get the wire strung properly. It is alleged by the plaintiffs that the trees were destroyed and they sued for $100 damages. In a justice's court they recovered a judgment for $11 and the defendant appealed to the Circuit Court. The case was tried there mainly on law points. The simple issue submitted to the jury was the question of damage and it found for the plaintiffs for $12. The question of public utility is involved and the case will go to the Appellate Court. Telephone men in Missouri are watching it with interest.

New Automatic Telephone-exchange System.

In a United States patent issued on December 12th to Gustave Seligmann-Lui, Paris, France, a novel system of automatic telephone exchanges is described. The subscribers' lines of the system are divided into groups, the lines of each group being presented on its own coupling board or boards having calling and called-line contacts in pairs whose members correspond to the two members of a line. Service contacts for the service of the exchange mechanisms are provided and with the line contacts are regularly arranged in series of rows so as to be accessible by a number of suitably located coupling devices. Each of these devices comprises two independently movable, electrically propelled and electrically associated mechanisms termed couplers. The couplers are respectively appropriated, the one for making connection with a called line and the other for making connection with a calling line, each coupler being adapted to move across its board, the couplers comprising a plurality of sets of line and service contact fingers, which respectively correspond to the several series of rows of contacts on the coupling board. Each set comprises a pair of line fingers whose members are designed to make contact respectively with the members of a pair of



NEW AUTOMATIC TELEPHONE-EXCHANGE SYSTEM.

line contacts, and a service finger designed to make contact with the service wire corresponding to the pair of line contacts, so that each set of line and service fingers is adapted to make contact with the line and service contacts of one or another row of contacts of the series to which that set corresponds. All the fingers of like function in the one coupler are in electrical connection with each other, and a magnetically operated multiple switch or distributor in connection with the called-line coupler is arranged to connect it at predetermined moments with the fingers of corresponding function of the associated coupler, there being as many couplers of each function located at each coupling board of similar function as there are groups of lines. The couplers, of the kind appropriated to make connection with calling lines, which are located at any one calling-line coupling board are electrically associated with couplers of the kind appropriated to make connection with called lines, which are severally located at called-line coupling boards severally apertaining to different groups of lines, so that each coupling device is adapted to telephonically couple together any two lines on the coupling boards at which the two couplers, forming the coupling device, are respectively situated. The accompanying illustration of the system is taken from the Patent Office Gazette.

United States Company's Service.

A representative of the Western Electrician was given an opportunity recently in Kent, O., by Mr. W. H. Butler of the United States Telephone company, to test the efficiency of this enterprising company's service over its long-distance lines. Conversations were carried on between Kent and Niles, 45 miles; Kent and Youngstown, about 60 miles, and to Newcastle, Pa., about 75 miles. The weather was not of the best for telephonic communication, but it must be said, to the credit of the management of the United States Telephone company, that the service was most excellent and satisfactory. As a final test, Mr. Butler secured a connection through Newcastle with Pulaski. This line was figured out as 100 miles in length. The service in this case seemed exceptionally good, the voice at the other end of the line being very clear and distinct, and although the speaker's tone was low, the accents were "bell-like" in their clearness. Mr. Butler has had occasion to test the line between Kent and Pulaski in a similar manner on quite a number of occasions, and each time he has found the service perfectly satisfactory, except on one occasion, when a railroad accident interfered with the Pulaski connection. The United States Telephone company's lines ramify Ohio, and when the company gets its Cleveland connection, which is expected within 30 days, it will also have communication, it is said, with western Ohio, Michigan, Indiana and Illinois.

Telephone Construction in Belgium.

Belgium is one of the countries of Europe where the telephone system is under the control of the government. The postal administration has lately made a number of extensions and improvements which will give that country a system not inferior to any in Europe. The new telephone station recently erected at Brussels is an example of the work now being carried on. This station is arranged for 15,000 subscribers, and has an extensive system of lines, some of which are now in construction. The administration has decided to place underground all the new lines within a radius of two miles from the station, as the number in use renders the overhead construction impossible. As the installation of an extensive system of this kind required a considerable amount of study, it was decided to send committees to different parts of Europe and to America in order to study the construction and methods used and to profit by their experience in the questions of cables and underground conduits. The system of cables to be employed is that in which paper and air insulation are used. Bids were accepted for these cables from Siemens & Halske and Felten & Guilleaume.

The underground conduit work presents several interesting points as to the method of construction. The total length of the underground system represents about 20 miles, and of this several miles has been already finished. The principle of construction is as follows: Each cable is drawn through a tube of glazed porcelain, these tubes being laid in a bed of cement. To accomplish this a trench is first dug along the line desired. The depth of this trench is about 4½ feet and its width three feet. The bottom, well smoothed, is covered with a bed of cement about four inches thick. This cement is of the kind known as slow-setting, and is formed by baking a mixture of carbonate of lime and clay, containing less than two per cent. of magnesia. It is made at least three months before using. Upon this bed of cement are placed the porcelain tubes. These have oblique joints and measure 1½ feet long, having an inside diameter of 3½ inches. The joints are made with cement mortar, and the inside is scraped out by a wooden piece provided with rubber rings, this being pulled along after the joints are cemented. A number of these porcelain tubes are placed side by side in the trench, according to the number of cables; the whole is covered with a layer of cement about four inches thick on all sides. After the cement has hardened, the trench is refilled with earth, whose minimum thickness is 1½ feet. Large manholes are placed along the trench at distances of about 500 feet. These manholes are constructed of brick on a bed of six inches of cement, and measure three by five feet inside, with a depth of five feet. They are closed by a cast-iron cover fitting into an iron frame, and special attention has been made to secure a water-tight joint. The work on this line is now going on rapidly, and one of the principal sections has already been finished. About 100 workmen are employed on the subdivisions of the line, which are about 1,200 feet long. The rate of progress is 500 feet a day.

TELEPHONY ABROAD.

From March 1 to October 31, 1899, the Mexican Telephone company's gross receipts were $102,861. The net receipts for the same period were $42,452, an increase of $7,329 over the corresponding period of 1898. The total number of subscribers on October 31st was 2,925.

In the city of Berlin has recently been installed a series of automatic telephone boxes, to the number of 100. These cabinets are so arranged that it is only necessary to put into the slot a coin whose value is less than half a cent in order to be connected automatically with the central station. At the same time a signal is given to the station from the box in question, and one may thus communicate with any point in the system. This system dispenses with the services of an attendant, such as is now necessary in the system in use in Paris, for instance, where the price of a communication is five cents.

A bill has been lately passed by the House of Commons by which licenses are granted to municipalities for the installation of telephone lines, and the bill also provides for the establishment of a new telephone system in London under the direction of the Postoffice Department. The National Telephone company, which has up to this time had the monopoly of the lines in the provincial districts, has now been obliged to make some concessions to subscribers. The company has taken measures toward reducing the rates and has now admitted two classes of subscribers. The first of these will be the yearly subscribers, and the second class is to be composed of those having a special arrangement by which they will pay but £3 10s. for the installing of the apparatus and an aditional rate of one penny for each communication. The telephone company announces that the new rate will go into effect at the end of the year, but it will apply only to the provincial districts. The policy of the company in London, upon the establishment of the new system by the Postoffice Department, remains to be seen, but the result cannot fail, in any case, to be of benefit to the subscribers.

Real Benefits of Competition.

[From the Springfield (Mass.) Union.]

A traveling salesman for a Springfield firm has collected interesting statistics regarding telephone rates in some of the cities and towns which he visits. A list of questions was made out and submitted to some reliable person in each place, and the answers to these questions are of considerable importance to this city in view of the agitation regarding telephone charges here. Accompanying the questions was sent the following letter:

Dear Sir: Our city has been paying the Bell Telephone company pretty stiff rates for telephone service, and a new company is seeking entrance to do business here. I have no interest in the telephone business, except to get the best terms for our citizens. While the matter is under consideration we are trying to get such information as we can from other places. Will you kindly fill out the answers to the enclosed list of questions and mail to me? I am not sure that you have two telephone companies in your city, but I know you have lower rates than we get, and would like to obtain such information as you can give me. By so doing you will greatly oblige.

Following is the list of questions:

1. Have you the Bell Telephone company in your city, and if so, what is the price for business purposes and for residences?
2. Have you any other company, and if so, what is the name of it?
3. What is the price given you by this company for business purposes and for residences?
4. What was the price of the Bell Telephone company before the new company entered the field?
5. Is the service of both companies satisfactory?
6. Do you think your city has been benefited by taking two companies?

Now for the answers. In substance, Huntington, W. Va., gives this testimony: To discourage competition, the Bell company is now giving free telephones. The rival company is the Huntington Mutual Telephone company, and its rates are $24 for a business telephone and $12 for a residence instrument. Before competition came in, the Bell company's charge was $48 a year.

The service of both companies is satisfactory and the city has been decidedly benefited by breaking the monopoly.

Grafton, W. Va., says: The Bell company charges $20 a year for office telephones and half that price in residences. The competition of the People's Telephone company reduced the Bell company's rates from $40 a year for offices and $36 for residences. It charges at present the same rates as the Bell company. Both companies give satisfactory service and the citizens think they have been greatly benefited by the competition.

From McKeesport, Pa., the following information was received: The Bell company makes its rate for office telephones $1.50 a month and for house telephones $1. Prior to the competition created by the McKeesport Telephone company, the Bell company charged $7 a month. The rates of the new company are $2.50 for an office and $1.50 for a residence instrument. Both companies serve the public well. Appended to the answers is the following:

"The city has been benefited very much by this new company, in that it has lowered the rates and gives more people an opportunity to have telephones. * * * The new company is only about three years old and at the present time has over 1,500 subscribers."

The man who answered the questions in Ironton, O., also sent a letter, which is, in part, as follows: "The Bell people had to get a hump on themselves when 'The Lawrence' came into the field, and their service is in no way equal to 'The Lawrence,' and they will put into private houses telephones without charge, and have done so all over town. Yet people would rather have the new 'Lawrence' at $1.50 a month. 'The Lawrence' has not been able to get telephones to supply the demand at all times. 'The Lawrence' is a local company, and a great many citizens in Ironton own stock. You will never regret getting a new telephone company."

From the answers to the questions it is learned that the Bell company for years charged $4 a month, but when competition came in dropped to $3. "The Lawrence" charges $2 for business instruments and $1.50 for house telephones. Since the introduction of the new company the service of the Bell company has greatly improved.

In reply to the question, "Do you think the city has been benefited by taking the two companies?" the answer is: "Very much. The argument in the outset was: 'We could not support two systems.' That has been exploded. 'The Lawrence' has over 400 subscribers and is growing rapidly. It takes no solicitors to sell 'Lawrence' telephones. The people are calling for them faster than they can be put in. The Bell company has about 200 free and paying telephones in all."

No Telephone, No Bank.

As a result of jealousy New Paris and Eldorado, in the lively state of Ohio, are as seething cauldrons of excitement. Mr. H. G. Bloom, a banker of New Madison, who owns a branch bank in both New Paris and Eldorado, desired to connect his branches with the main house by private telephone line. He had the line all built except in the corporation of New Paris. There the Town Council first stopped him and then gave permission to run in two wires. He again commenced work and was arrested by the marshal and fined $10 and costs by the mayor. Everybody took sides. Mr. Bloom may withdraw his bank from New Paris (it being the only one there), and it is said will bring suit against the town for illegal arrest and confinement.

Sterling Electric Company.

The illustration represents the new factory building of the Sterling Electric company at Lafayette, Ind. The growth and development of this enterprising company are of much interest. Little more than 20 months ago Mr. Frank B. Cook, formerly chief engineer for the Central Union Telephone company, and Mr. W. E. Doolittle, also well-known in telephone circles, conceived the idea of furnishing the Independent field with apparatus "identical with the Bell." This was made possible by the fact that Mr. Cook controlled and owned patents under which Bell apparatus was manufactured. A company was formed and incorporated under the laws of Illinois, and early in 1898 it began doing business from an office in Chicago in a small way, under the name of the Sterling Electric company.

Surpassing the most sanguine expectations of the founders, the business of the new venture increased

STERLING ELECTRIC COMPANY'S NEW FACTORY.

so rapidly that after twice enlarging its quarters, the company was finally forced to secure a location that would allow it still greater possibilities in the way of "expansion," and the result is the plant at Lafayette, Ind., of which the Sterling people are justly proud and which is housed, they assert, in the largest building in the United States owned and occupied by an exclusive telephone-manufacturing company. The dimensions of the building are 225 by 60 and 100 by 60 feet, three stories in height, and it is equipped with the latest and most expensive machinery required in the production of all parts of the company's output. These enlarged facilities will enable the Sterling Electric company to satisfy the demand that has long been made on it for telephones, a full line of which, for all the various requirements of service, will be added to the switchboards and protective devices which have heretofore constituted the bulk of its business.

Alliance True to Its Name.

Not all the troubles of telephone managers are due to competition or to irate subscribers. The Review of Alliance, O., tells of an entirely different perplexity. "Manager James B. Douglass of the Alliance telephone exchange," it says, "is having enough trouble to turn an ordinary man gray since Cupid became entangled in the network of wires that are strung about the city. Six months ago, Mr. Douglass, his line foreman, J. C. Terwilliger, and his chief operators, Miss Dean Caris, Miss Kate Neuwirth and Miss Ruby Peterson, were all single. Since then the manager became charmed by the little wizard of love and was married to Miss Annetta Moore. Mr. Terwilliger won the heart of Miss Caris, and she changed her last name accordingly. Miss Neuwirth later became Mrs. Thomas Numan and Miss Peterson is now the bride of C. Fred Neuwirth. This alone is not the cause of Mr. Douglass' worries, but the annoyance arises from the fact that every marriageable girl in Alliance seems to think that a charm lies hidden in the central exchange. Manager Douglass, since the Neuwirth-Peterson nuptials, has received earnest applications for positions in the telephone exchange from 11 misses who are now well advanced into the state of spinsterhood, four widows, one of whom is young and dashing, three old bachelors and any amount of unmarried girls who are beginning to hover about the anxious seat. Every time 'Jim' hears the telephone bell ring he becomes nervous for fear it is a wedding ring, and he says if he could lay his hands on that litle scamp, Cupid, he would surely wring his neck."

New England Company Is Modest.

At a recent aldermanic hearing in Fall River, Mass., on the application of the Fall River Automatic Telephone company for permission to lay conduits and operate a telephone system in that city, Mr. Swift, counsel for the New England Telephone and Telegraph company, appeared in opposition. He asked for a postponement, that he might summon experts to testify as to the worth of the new system. Mr. Swift also made the statement that his company intended to allow all earnings in excess of six per cent. to be spent in reducing the price of telephones.

On the part of the applicant it was stated that after eight years the city might buy the plant. For the new company Dr. R. T. Davis, president; Colonel B. D. Davol, treasurer; W. B. M. Chase, H. A. Dubuque, John B. Hurd, and Dr. John W. Coughlin spoke. John L. Watson, manager of the exchange in Auburn, N. Y., explained the system.

Litigation in Rochester.

In Rochester the Bell Telephone company does not contemplate with pleasure the opposition promised by the Rochester Telephone company. At a recent meeting of the Common Council of that city a resolution was adopted requiring the Bell company to rent to any applicant ducts in its conduits and space on its poles. The resolution was based on a clause in the contract between the city and the old company, which was entered into in 1888 at the close of the famous "telephone war" in Rochester. However, the company objects to the Common Council's interpretation of the contract and has brought suit to restrain the new company from using its poles and conduits under the terms of the resolution of the aldermen. In this suit the city of Rochester, the mayor of the city and several electric-light companies are named as co-defendants with the Rochester Telephone company. The Bell company contends that the resolution of the Common Council is illegal. One paragraph of its complaint reads as follows: "That the proposed modification of the contract between the city of Rochester and the plaintiff will cause irreparable injury to plaintiff and will destroy vested rights of plaintiff, and is a modification not contemplated by the parties to said contract, and will divert the property to plaintiff, from the use for which the same is intended, and that plaintiff has no legal right to allow its property to be used for the purpose and in the manner contemplated by the resolution." A temporary injunction has been granted the Bell company pending the result of the suit.

At a later date Mayor Warner vetoed the resolution of the Common Council, asserting that the telephone contract ought not to be modified without giving the Bell company opportunity to be heard.

EXTENSIONS AND IMPROVEMENTS.

Five new long-distance circuits have been strung from Detroit to Mt. Clemens and Port Huron by the Michigan Telephone company, thus insuring prompt service to those stations as well as to intermediate points.

The stockholders in the Erie Telegraph and Telephone company have voted to increase the capital stock of the company from $5,000,000 to $15,000,000, in accordance with the recommendation of the directors, recently noticed in the Western Electrician.

The Henderson Telephone company is extending its plant at New Berne, N. C., to meet the requirements of 300 subscribers. The chief work is the hanging of two cables from the exchange, one to Middle and Broad streets and the other to the junction of Middle and Craven streets. These cables contain 100 wires each. New and improved lightning arresters have been put in place. A new section is added to the switchboard at the central office. The work is being done under the direction of Superintendent F. C. Toepleman, who is in charge of the various systems owned by the company.

In a recent interview in the Cleveland Plain Dealer Mr. Henry Everett is thus reported on the telephone situation: "Wait until they [the eastern capitalists] get out into the field as we are, and they will find out the job requires plenty of hard work. When they find the fields occupied and run against the courts they will have a different idea of the proposition. After they are enjoined about 100 times from carrying on their work they will discover they have no easy task in front of them. Our company has been enjoined 13 times, and we have been handicapped by all kinds of strikes on our building, but we have gone right on, and now I believe the end is in sight. Our new building will be ready for the operation of our company in a very short time. We have had to surmount every conceivable kind of an obstacle to carry through the project, and we will now be in shape shortly to serve the people."

MANUFACTURERS AND DEALERS.

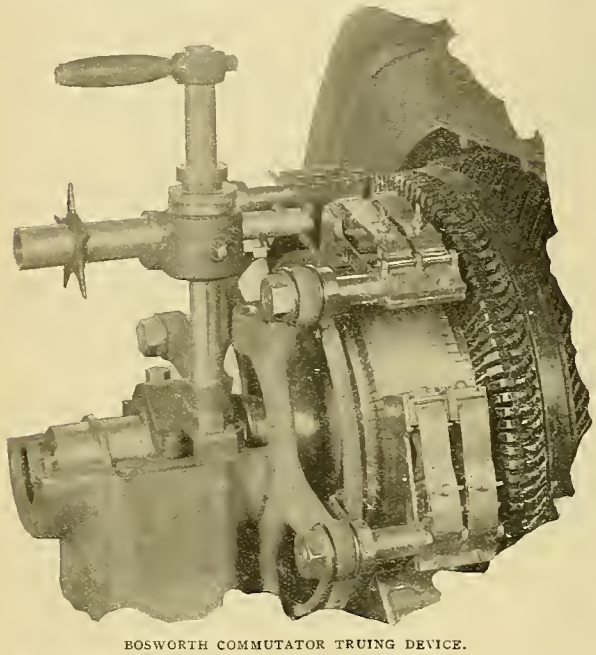
It is said that the Western Telephone Construction company of Chicago will remove its plant to Winthrop Harbor, a new manufacturing town on Lake Michigan, bordering on the Wisconsin state line and midway between Chicago and Milwaukee.

Buyers of telephones and telephone supplies will be interested in the announcement of the Modern Telephone and Supply company, Chicago, which was recently formed to engage in the manufacture of telephones and telephone supplies. It is stated that the Modern company will manufacture and handle only the highest grades of goods, being in a position, moreover, to make exceptionally low prices, owing to the fact that its goods will be manufactured from raw material which it will purchase in large quantities and for spot cash. The principal owners, William Hauptman and George E. Cowen, will personally supervise the manufacture of the company's goods. Mr. Hauptman is a practical telephone man and has had a wide experience in the manufacture of telephones. He will be ably assisted by Mr. Cowen and other experienced men. The Modern company's factory, which is located at 56 Fifth avenue, is equipped with the latest machinery. A descriptive catalogue giving net prices has just been issued and will be cheerfully sent to anyone on request. The Modern company gives the Foreman Bros. Banking company as reference.

Bosworth Commutator Truing Device.

All electrical men are familiar with the necessity of exactly adjusting the brushes of a dynamo or motor in order that sparking may be avoided and best results obtained from its operation. The commutator and brushes constitute the most sensitive part of the machine, and a very little irregularity in respect to these two particulars may result in much loss because of impaired efficiency, waste of energy and sometimes ruin of the machine. Hence stress may be laid upon the injunction to keep the commutator clean and smooth. The smoothing of the commutator is generally accomplished by turning it down.

Instead of sending the armature to a machine shop in order to have its commutator turned down one may, by the use of an apparatus such as the Bosworth truing device, do the work without, as a rule, removing the armature from its journals. The illustration represents one form of this device and shows the method of attaching it to the armature shaft by means of clamps. In operation the apparatus is either revolved about the shaft by hand



BOSWORTH COMMUTATOR TRUING DEVICE.

power, or, if it is desirable to leave the armature in the machine, a crank is attached to the pulley, and the armature and commutator rotated, while the truing device is held stationary. There is provided, when desired, an extension tool holder and clamping plate, by which the truing device is made applicable to any form or size pedestal or commutator.

In using this device upon street-car motors, and in a very few other cases of especially designed machines, it is necessary to remove the armature from the machine, but only enough to permit the truing device to revolve about the shaft. In general use a commutator can be turned down without removing the armature from its journals.

The tool is strongly built and with ordinary use, it is asserted, will last for many years. It is controlled by the Akron Electrical Manufacturing company of Akron, Ohio, and is made in two sizes, one being adapted to commutators of six inches and less in width and not exceeding 17 inches in diameter, the other being intended for larger sizes.

Probable Extension of Metropolitan Elevated Railway.

For some time there has been talk of a connection for suburban traffic between the Chicago, Burlington and Quincy railroad and the Metropolitan elevated system in Chicago. The Metropolitan directors have just authorized their finance committee to extend the Douglas Park line from the present terminus at Campbell avenue to Douglas Park boulevard, where an incline would afford easy connection with the Burlington tracks. Cars practically the same as those used on the Metropolitan system are to be employed by the Burlington if the contemplated settlement is reached. To avoid all question as to the right of the Metropolitan road to accept this traffic it is understood that the Burlington trains will be absolutely surrendered to the Metropolitan company as soon as they are taken upon the elevated structure. They will run on a timetable fixed by the elevated company, make all stops around the loop, be hauled by Metropolitan electric-motor cars and be in charge of Metropolitan crews. This agreement, when perfected, will add from 15,000 to 20,000 to the daily traffic of the Metropolitan road, and it is understood the Burlington will pay five cents per capita for the service.

The town of Tupelo, Miss., has issued specifications for the construction of an electric-light plant which will include a building, steam equipment, electrical apparatus and line material.

CORRESPONDENCE.

New York Notes.

New York, December 16.—A report was extensively circulated in Wall street this week that the control of the Brooklyn Rapid Transit company had passed iinto the hands of a syndicate in which the Whitney-Vanderbilt, E. H. Harriman and A. N. Brady interests were identified. It was further said that this movement was only the first step in a gigantic scheme to consolidate all the heat, light, power and transportation properties and businesses of New York. So far as can be ascertained, however, from the interests mentioned there is no foundation for the rumor. Another report that involves some of the same interests is that all the gas and electric-lighting companies in Queens Borough doing business exclusively in the borough, with the exception of the Newtown and Jamaica Gas Light companies, which are branches of the Union Gas Light company of Brooklyn, have been acquired by the Elkins-Widener-Whitney syndicate, and are soon to be part of the big lighting combination which, it is believed, is being engineered by the syndicate. The combination, it is said, will bid for the entire street lighting of the borough of Queens. The Jamaica Electric Light and Power company is to be the name of the concern in Queens Borough.

At a meeting of the board of directors of the Manhattan Railway company Tuesday, the regular quarterly dividend of one per cent. was declared. One of the leading directors said after the meeting that in all probability part of the elevated-railway system would be operated by electricity within a year. The excavation for the big power house to be erected at Seventy-fourth and Seventy-fifth streets and the East River, he added, was going on steadily, although the fact that a bed of solid rock had been encountered necessarily made the progress of the work rather slow.

Fire damaged the Electric Vehicle company's four-story building at 215-219 East Forty-second street to-day to the extent of about $60,000. The entire four floors were stocked with electric vehicles in different stages of completion, and about 50 of the automobiles occupying the third and fourth floors were damaged or destroyed. Talbot J. Taylor, of the Stock Exchange firm of Talbot J. Taylor & Co., has been elected a director of the Electric Vehicle company, succeeding J. M. Hill, a former Chicagoan.

Notices have been sent to members of the Automobile Club of America, calling them to a special meeting in the clubrooms, at the Waldorf-Astoria, next Tuesday evening, to act upon a challenge for the International Automobile Cup. Two proposals from American manufacturers have been received, and if satisfactory assurances are furnished that carriages capable of developing high speed will be taken to France and run in the race, both candidates will probably be named, and possibly a third will be authorized.

Experiments with an up-to-date automobile omnibus, driven by electricity, will be begun by the Fifth Avenue Stage company next week. This omnibus has comfortable accommodations for eight persons inside and six others can be carried outside. It has a storage battery capable of furnishing power for a 35-mile run. There is one motor geared to the rear axle and having a normal capacity of four horse power, but capable of developing three times that power when needed on grades. The wheels are of wood, with heavy cushion tires. There are three speed gears and a maximum of 10 miles an hour over a good road can be attained. The omnibus was made in Hartford, Conn., and its total weight, including the storage batteries, is 4,500 pounds. Passengers will be charged the usual five-cent fare, and a careful record will be kept of the number carried, the time required to make each trip, the consumption of electricity and other data useful in designing the automobile omnibus of the future.

The directors of the Third Avenue Railroad company, at a meeting on Tuesday, voted to accept the conditions imposed by the Board of Estimate for the franchise for the King's Bridge, Fort George and Eleventh Avenue railroads. The company expects that it will be 12 or 15 years before the road earns its operating expenses, because of the concessions it had to accede to, but on account of the company's investment, it was said, it was decided to accept the city's terms.

Plans have been filed by the Metropolitan Street Railway company for a four-story brick car house at Ninth avenue and Fifty-fourth street, which, it is estimated, will cost $250,000. The new building, which will be constructed of brick, will front 135.10 feet on Ninth avenue, 523 feet on Fifty-fourth street and will extend 200.3 feet to Fifty-third street, on which it will have a frontage of 115 feet. The car stables now occupying the site are being torn down to make way for the new building.

A resolution asking for an appropriation of $50,000, to be used in investigating plans for a tunnel under the East River from Whitehall street to Brooklyn and the bay to Staten Island, was adopted at a meeting of the Board of Aldermen recently. The plan is to have the tunnel connect with the proposed rapid-transit tunnel.

A movement is on foot to raise $500,000 for the erection of a building which shall be the home of all the scientific societies of New York composing the Scientific Alliance. These organizations are the New York Academy of Sciences, the Torrey Botanical Club, the New York Microscopical Society, the Linnæan Society of New York, the American Mathematical Society, the New York Mineralogical Club, the New York section of the American Chemical Society and the New York Entomological Society. It is planned to erect the building on the West Side, between Forty-second and Forty-ninth streets.

M. L. G.

Northwestern Notations.

Minneapolis, December 16.—The County Court at Oshkosh, Wis., has decided that the license fees paid by the Citizens' Traction company do not free it from taxation on real estate held in towns. The company owns a park and declined to pay taxes on the plea that the license fees were sufficient. The company has altogether 30 miles of road.

Frederick G. Dusten has been appointed electrical inspector in Minneapolis, succeeding C. L. Pillsbury, resigned.

The Pioneer Iron company has discontinued hand work on its stock-pile trestles at Ely, Minn., and substituted electric motors. The electric system works well, both underground and on the surface.

Stone & Webster of Boston have been granted an amended franchise for a street railway at Houghton, Mich. They have been refused a franchise at Hancock. Work will be started in Houghton at once on the nucleus of a belt line to cover the copper country.

The city of Helena, Mont., is taking bids, until January 2d, for furnishing an electric-light plant.

The contract for a new fire-alarm system for Minneapolis has been let to the Gamewell Fire Alarm Telegraph company at $10,525. An allowance of $2,525 for the present office equipment was made, making the net cost $8,000.

The intention of the street-railway company of Des Moines, Ia., is understood to be to construct a line to Bondurant, Ia., soon.

The press at Hammond, Wis., urges that steps be taken to induce the installation of an electric-lighting plant.

The gross earnings of the Fond du Lac (Wis.) Street Railway and Light company for the year ended December 1st were $32,196, an increase over the previous year of $11,644. This company has just opened the Scott street extension.

The Seattle (Wash.) Electric company now operates four of the six transit lines of the city, viz., Seattle Traction company, the Union Trunk line, West Street and North End and the Madison street cable road. The two remaining systems will soon be under the same control.

The Fox River Valley Electric Interurban Railway company of Menasha, Wis., reports gross earnings for the year ended December 1st as $38,000.

The electric-light company of Platteville, Wis., has made a proposition to furnish 13 arc lights of 1,200 candle power at $50 a lamp per annum, and 100 incandescent lamps of 32 candle power at $15 a lamp per annum. If the proposition is not accepted the company offers to accept the average of the prices made by 10 or more cities recently having made contracts for lighting, where the prices for fuel are similar. If this does not suit, the matter is to be left to practical engineers, the council to select one, the company another, and the two a third, all to be unconnected with any electric construction company. They are to estimate the cost of running the plant for 10 years, and the company agrees to contract for lighting at five per cent. over the figure they agree upon.

The Mineral Point and Northern Railway company has been formed to construct an electric railway from Mineral Point, Wis., to Highland.

A council committee at Chaska, Minn., recommends establishing an electric-light plant, at a cost of about $6,000.

Clear Lake, Ia., has just made a six-year contract for street lighting.

The Mason City, Ia., electric-light plant is trying straw instead of coal for fuel.

Henry Pyle of Macksburg, Ia., has bought a half interest in the Iowa Electric and Construction company of Des Moines.

The electric-light plant at Valley Junction, Ia., has been completed and put in operation.

An engineer at the electric power house at Muscatine, Ia., had his face and eyes badly injured by an electric flash from the machinery. It will probably lay him up for a month or more.

Warner Miller of New York and others are said to be interested in the development of the water power at Kettle Falls, in Washington. The plan is said to include the construction of an electric railway from Republic, Wash., to Spokane, which will bring down the ores from the mines to the smelters.

An electric-light plant is proposed for Howard, S. D.

Another large dynamo will probably become necessary for the electric-light plant at Two Harbors,

Minn., as the demand for lights is rapidly approaching the limit of the present machine.

Slayton, Minn., will vote on bonds for $20,000 for the establishment of an electric-light and waterworks plant.

The Owatonna Electric company of Owatonna, Minn., is putting in new machinery, changing the switchboard connections and making other changes.

The Holt Lumber company of Oconto, Wis., has completed an electric-light plant and is furnishing light for the streets.

The city electric-light plant at Lake City, Minn., is considerably overloaded, and consumers have been asked to go as lightly as possible until the new generator can be installed.

The Butte General Electric company of Butte, Mont., has transferred its property to the Butte Lighting and Power company.

The electric-light plant in Stevensville, Mont., which has been idle for about two years, has been sold to parties in Butte and will be removed at once.

The council of St. Paul has awarded the contract for electric and gas street lighting in St. Paul for the coming year to the St. Paul Gas Light company, at practically the same terms as the 1899 contract.

A controversy is raging in Fond du Lac, Wis., between the Fond du Lac Street Railway and Light company and the Chicago and Northwestern railway over a crossing, to which the railroad people object.

David Askegaard of Moorhead, Minn., sued the Western Union to recover profits on 18,000 bushels of wheat which plaintiff's broker failed to buy, owing to telegraphic error. Askegaard ordered his broker to buy 20,000 bushels of wheat, and the telegram was delivered "2,000 bushels." The court directed a verdict for the defendant on the ground that it was a deal in futures and not a real purchase and not to be recognized in law; also that profits are something that cannot be figured out, and the error might have resulted in a saving to the plaintiff, as well as a loss.

W. F. Brundage has been granted a franchise at Sherburn, Minn., to put in electric lights, the franchise to run for 20 years.

Two electric carriages have appeared on the streets of Minneapolis. They were sample vehicles of the storage-battery order, which have been sent to the city by an eastern company which proposes to start a branch factory. R.

Canadian Intelligence.

Ottawa, Ont., December 15.—After sustaining the struggle for seven months, the Trades and Labor Council of London, Ont., has declared off the strike of the employes of the London Electric Street Railway company.

Dean Bovey of the Faculty of Applied Science at McGill University, Montreal, has received word from Professor Owens that a friend of his has given $10,000 to found a research scholarship at McGill in electrical engineering.

The new long-distance line which the Bell Telephone company is constructing between Ottawa and Brockville, Ont., and which will join other long-distance lines at the latter point, is now constructed to within four miles of Brockville. The completion of the line will be rushed and will be ready for operation shortly.

Mr. John Patterson, the chief promoter of the electric railway to Berlin, Galt and Waterloo, in the province of Ontario, and the railway to Guelph and intervening points, has written to the local papers that unless the city of Hamilton, Ont., which would be a great gainer commercially by the lines, can see its way clear to meeting the wishes of the company in the matter of right-of-way, the project will be abandoned. The company wants right-of-way through Dundurn Park in the city.

The Jones & Moore Electric company of Toronto shipped five motors to Vancouver, B. C., during the month of November. So great is the demand that the firm finds difficulty in filling its orders. The demand is much in advance of former years in the company's experience.

The Canadian General Electric company has received an order from the Trenton Electric company of Trenton, Ont., for a 75-light equipment of alternating-series, enclosed arc lamps, with automatic regulating transformers and switchboards. These are to be used for street lighting in Belleville, Ont., the current being taken from the three-phase transmission lines, coming from Trenton, a distance of 13 miles. This is the third installation of the kind in Canada.

The second locomotive in Canada electrically driven has just been put in service on the Metropolitan railway, Toronto, Ont. The locomotive was manufactured at the Baldwin Works, Philadelphia, Pa., and weighs, when completely equipped, nearly 50 tons. The power of draught of one of these engines is fully equal to that of a large mogul engine and a guarantee accompanies it that it is capable of drawing a 30-ton car up a grade of nine in 100.

When the stock of the Canadian General Electric company of Montreal, which has been held for some years by the General Electric company of New York, was some months ago bought by Canadian shareholders, vacancies in the board of directors of the Canadian company were caused by the retirement of the directors who had heretofore represented the interests of the American company. At a meeting of the Canadian directors of the Montreal company, held in that city on December 12th, the vacancies were filled by the election of Sir William C. Van Horne and Herbert S. Holt, president of the Montreal Gas company, as directors. At this meeting, also, the usual dividend of three per cent. for the half year was declared on the preference stock. A dividend of four per cent. for the half year, together with a bonus of two per cent., also, was declared on the common stock, making a total of 10 per cent. on the common stock of the company for the year.

The Electrical Maintenance and Construction company of Toronto, which began business less than a year ago, has had a remarkably successful career at the start, having expanded until it has now contracts in hand largely aggregating over $100,000. In view of the development of its business, it has been found necessary to increase the capital stock from $20,000 to $250,000. One of the contracts this company has in hand is the construction of the extensive Orillia power plant.

The Canadian Electric Light company of Quebec is getting extensive work done at Chaudiere Falls, eight miles west of Levis, Que., on the Chaudiere River. The Engineering Contract company, which has the contract to put up the dam and the power house, has had a large force of men at work since the end of August last, and it is expected that everything will be completed early next spring. The Canadian Electric Light company will then be in a position to supply light and power to consumers. The City Council of Levis will very likely use electric power for their contemplated waterworks, and the city will also be lighted by electricity. There are also good prospects of a company being formed to build and operate an electric railway between St. Romauld and St. Joseph de Levis.

During the last week, in the Montreal stock market, the most interesting feature was the advance in Royal Electric to 195 on the strength of the settlement of the legal troubles between the Royal Electric company and the Chambly Power company, which have been pending for some months. Of course, the information of the coming adjustment was the particular property of the insiders, but as something in that line was the only thing that could be made the basis for such an advance, there was an idea that a favorable settlement must be near at hand. The advance was started from 160, so that it was one of the most extraordinary of the year.

The biggest dynamo in Canada, it is said, will be that in the new power house of the Ottawa Electric company of Ottawa. It will weigh 107 tons, stand 18 feet high and develop 1,700 horse power. It will run, by itself, the whole electric-car system in Ottawa. This generator was constructed at the Westinghouse shops in Pittsburg, Pa., and cost about $40,000. It will be direct-connected to turbines. These turbine water wheels, six in number, revolving on one horizontal axle, are placed one behind the other, their respective size increasing as it draws to the other end of the shaft, and are calculated to develop 2,000 horse power. The plant now in use will be held in reserve.

The National Cycle and Automobile company, with a capital of $2,500,000, has secured temporary premises in the city of Hamilton, Ont., and will build its factory there at once. This company has selected the city of Hamilton in preference to Toronto, where it was first proposed to establish its works, on account of the cheapness of the electric power which is now obtainable in the former city. Thus, by being able to furnish cheap electric power, Hamilton is outbidding the larger city of Toronto in securing industrial concerns. Two other smaller factories, each employing 400 hands, are also negotiating with the Hamilton authorities for sites in that city. The cheap electric power furnished by the Cataract Power company is the all-important factor in these negotiations and is the drawing card for Hamilton. It cost the Cataract Power company $500,000 to develop its power, which is produced at Decew's Falls, nearly 40 miles from the city, and transmitted at additional cost over expensive copper cables to Hamilton. It is also stated that some Boston, Mass., basket manufacturers, in consideration of being able to obtain this power on so cheap a scale for manufacturing purposes, have been interviewing local fruit growers, with a view to establishing a basket factory in Hamilton. W.

New England News.

Boston, December 16.—The city election this year had for one of its incidental features a referendum on the question of replacing street-railway tracks on Tremont street, one of the principal business thoroughfares. When the subway was constructed one of the purposes for which it was designed was relief from car congestion and delays on that street, and it was provided that the tracks should be removed. People who were accommodated by the Tremont street surface cars, however, have been agitating ever since for the replacement of these tracks and renewal of surface accommodations in addition to present subway facilities. They secured the passage of an act by the last Legislature submitting the question to popular vote. Last Tuesday the will of the people was expressed, and much to the surprise of advocates of Tremont street cars, the verdict was about two to one against them.

The Massachusetts railroad commissioners have granted to the Lexington and Boston Street Railway company permission to extend its tracks in the town of Concord, and it will soon be practicable to go over a large part of the route traversed by the British troops on the famous 19th of April, 1775, in trolley cars from Boston.

There was a hearing before the selectmen of Brookline, Mass., last Tuesday, on rival petitions of the Boston Elevated railway and Boston and Worcester street railway for locations to the Newton line.

It is probable that the deferred payment of $50 a share on the Boston Elevated Railway company's stock may be required and called for early in 1900. The original plan contemplated five monthly installments of $10 each, but later reports indicate that two installments of $25 each will be announced, one payable by March 1st and the other by June 1st. Construction work, which was interrupted last month by non-arrival of material, has just been resumed.

The Gardner, Westminster and Fitchburg Street Railway company has been granted by the railroad commissioners permission to acquire the Gardner electric street railway; also to issue $100,000 in original capital stock and $50,000 additional, to be used in effecting an exchange of shares with the Gardner company. B.

PERSONAL.

A. M. Little, secretary of the American Electric company of St. Paul, Minn., was a recent Chicago visitor.

R. Ackerman, of the New York office of the Western Electric company, is spending a few days in Chicago on business.

John D. Saulsbury, official photographer of the Signal Corps in the Philippines, and an electrician, was recently captured by the Filipinos and is still held a prisoner.

Colonel P. P. Lane, senior member of the Lane & Bodley company of Cincinnati, O., the well-known engine-manufacturing concern, died on December 6th, at the age of 78.

Mr. M. L. Joslyn of Woodstock, Ill., well known in connection with the electrical activities of McHenry County, was in Chicago last week. Mr. Joslyn says that the electrical outlook in the northern part of the state is excellent.

Mr. T. E. Podlesak, formerly of the Omaha Electrical Works, is a late acquisition to the staff of the Siemens & Halske company in Chicago. Mr. Podlesak is a graduate of the department of steam and electrical engineering of the University of Nebraska and his friends predict a successful career for him.

Mr. William D. Ball, an electrical engineer of Chicago, has been appointed by Commissioner-general Peck as engineer of construction on the staff of Mr. F. E. Drake, director of machinery and electricity of the United States Commission to the Paris Exposition. Mr. Ball will leave in about three weeks for Paris, where he will remain throughout the exposition.

According to the Freeman's Journal, the mother of Marconi is an Irishwoman, and not English, as has been stated. This lady is said to be "the daughter of Power of Gurteen, one of the haughtiest of the rural Irish aristocracy." It is added that "Marconi has lived a good deal in Ireland among his mother's relations, but he was born and educated in Italy. He considers himself fully half Irish, and many of his characteristics are more Irish than Italian. Marconi's first practical experiments with wireless telegraphy were made in Dublin Bay. The first wireless telegraphic newspaper dispatch was printed in the Dublin Independent."

ELECTRIC LIGHTING.

The city of Fordsville, Ky., will purchase machinery for electric-light plant. L. R. Bruner may be addressed.

The San Angelo (Tex.) Light, Power and Irrigating company wants machinery for an electric-lighting plant, 500-volt, direct current, and from 12 to 15 kilowatts.

The lowest bid received by the general superintendent of the army-transport service for the installation of an electric-light plant in the transport Crook was that of F. B. Ellis of New York, whose bid was $6,997.

A Strasburg correspondent of the Chicago Record asserts that municipal electric lighting has proved a striking success in Carlsruhe, capital of the grand duchy of Baden, a town of 84,000 inhabitants. The electric-light works have paid a big annual dividend, it is said, and the directorate has just decided that the profits warrant an enlargement of the works at an expense of 500,000 marks ($119,000).

ELECTRIC RAILWAYS.

Over 150 new trolley cars will be put on the lines controlled by the Union Traction company of Chicago before next spring. The cars will be 45 feet in length and will be capable of seating 75 passengers.

The Barberton, Doylestown and Massillon Electric Railway company has been incorporated for $50,000, by A. E. Townsend, W. A. Garver and G. E. Gardner, to build an electric railway from Barberton, O., through Johnson, Jamestown,

Doylestown, Canal, Fulton and Massillon to Canton.

At a meeting of the board of directors of the Columbia (S. C.) Electric Street Railway, Light and Power company, held recently, Mr. Edward B. Clark was elected general manager and treasurer of the company.

The J. G. Brill Car company of Philadelphia is now engaged in building a large number of double-deck trolley cars for the General Traction company of Paris, which will operate street tramways from the center of the city to the exposition grounds in 1900.

A dispatch from Oshkosh, Wis., says the preliminary steps have been taken toward the construction of an electric interurban road from Oshkosh to Omro and intermediate towns. It will be under control of the Citizens' Traction company of Oshkosh.

W. J. Pollard, J. Vey and C. F. Rengsegger, residents of Buchanan County, Mo., have asked the County Court for a franchise for an electric railway which they propose to build from St. Joseph, Mo., to Savannah, Andrews County, at a cost of $100,000.

The Massachusetts Electric Companies show an increase of 18.97 per cent., amounting to $52,633, for gross earnings in November this year, compared with the corresponding time in 1898. This indicates the growth of street-railway interests in the eastern part of the state.

Suit for $12,000 has been begun at the instance of the village of Wilmette, Ill., against the Chicago and Milwaukee Electric Railway company. The amount is claimed as compensation for the franchise granted to the defendant company to run its tracks through the village.

The City Council of Vicksburg, Mich., has granted a franchise to the Grand Rapids and Kalamazoo Electric Car company to run its cars through the streets of Vicksburg. It is said that the line will be extended eventually through Fulton, Athens and Union City to Coldwater.

A party of promoters, among whom are Dr. O. H. Lane, F. A. Smart, Frank O. Edwards and John Winter, president Detroit, Rochester, Romeo and Lake Orion railway, have asked the City Council of Grand Haven, Mich., for the right to enter the city with a new electric line from Grand Rapids.

It is understood that the plan for the purchase of the Yerkes holdings in the Chicago Consolidated Traction company by Union Traction interests will involve the organization of a new company to take over the securities in the same way that Union Traction took over control of the North and West Chicago companies. Payment is to be made in 4½ per cent. debentures, to be guaranteed by Union Traction.

The Greenville (S. C.) Traction company has organized by electing Joseph S. Keen president, George M. Bunting vice-president, and James H. Davis general manager. The company is principally composed of Philadelphians and is capitalized at $200,000. It announces that it intends constructing about five miles of line in the city and suburbs. W. C. Cothran at Greenville is acting as attorney for the company.

An electric-railway company has been formed at Middleboro, Mass., to connect that section with points on Cape Cod. It will build a line 20 miles long, if franchises sought in the towns of Middleboro, Rochester, Wareham and Bourne are secured. The proposed name is the Middleboro, Wareham and Buzzard's Bay railway. An opposition line is also under subscription, to be called the Boston and Cape Cod street railroad. The latter would connect with a line to Fall River.

The Detroit (Mich.) and Northwestern Electric Railway company has secured a private right-of-way between Farmington and Northville, and has graded all that branch, a distance of eight miles, to within one mile of Northville. The company has commenced running cars between Detroit and Farmington, a distance of 19 miles. The line between Farmington and Orchard Lake is all graded, and it is expected that the road between Detroit, Northville and Pontiac will be completed in a few days.

Electric-railway companies in and about Detroit are doing a good business. The gross earnings of the Citizens' Street Railway company for the last week of November were $34,399, against $30,588 for the corresponding week of last year. The Detroit Electric Railway company for the last week in November reports gross earnings of $13,117, against $10,556 for the corresponding week of last year. The gross earnings of the Fort Wayne and Belle Isle railway during the last week of November were $5,649, against $4,654 in 1898.

The street-railway companies, nine in all, operating in and around Allentown, Pa., were reorganized recently and merged into one concern. The reorganized company is to be known as the Lehigh Valley Traction company. The capital stock of the company is $3,000,000 and the bonded debt $3,000,000 at four per cent. The following-named officers were elected: President, A. L. Johnson; vice-president, Tom L. Johnson; secretary, J. E. Kenny; directors, A. L. and T. L. Johnson, Samuel Harris, Robert E. Wright and W. J. Hartzell.

Articles of incorporation have been filed for the Detroit (Mich.), Lake Orion and Flint Railway company. The new company is composed of John Winter, Henry Stevens, Dr. O. H. Lane and Frank C. Andrews, the incorporators being almost identical with the owners of the already-existing Detroit, Rochester, Romeo and Lake Orion railway. It is thought that the ultimate destiny of the new company will be a consolidation with the older company. The new road is to run from Oxford to Flint, passing through Ortonville, a total distance of 30 miles. It will connect at Oxford with the Detroit, Rochester, Romeo and Lake Orion line, and offer to the latter road a terminus at the city of Flint.

Leopold M. Stern of Chicago recently brought suit against the Union Elevated Railroad company to collect damages to the extent of five cents for alleged breach of contract. The plaintiff has been awarded the damages claimed, but the defendant company has prayed an appeal to the upper courts, which carries with it a suspension of the payment of the debated five-cent piece and $1 court costs. Stern alleges that on October 16th last he waited at a station of the "Loop" for half an hour, and as no train came he demanded the return of his fare, which was refused. Mr. Stern pleaded his own case. In bringing the suit he said he was actuated by motives purely in the interest of the public nd desired to make a test case of the rights of citizens. The company admitted the delay of the trains, but claimed not to be responsible for such accidents.

AUTOMOBILES.

It is stated that sealed bids for furnishing an automobile mail-wagon service have been received at the Chicago postoffice and forwarded to Washington.

The Illinois Electric Vehicle Transportation company of Chicago has secured a three-store building at 4614 Cottage Grove avenue, which it has converted into a model sub-station. The company has also established a sub-station on the North Side at 285 North State street.

"Automobiles" was the subject of a discussion for the holiday meeting of the Northwestern Alumni association of the Massachusetts Institute of Technology, held in Chicago, on December 18th. After the dinner C. E. Woods read a paper on "The Automobile, Its Status and Future."

A new style of automobile, in which acetylene supplies the motive force, is to be produced by a firm in New York city. It is said that with the motor used, which is of 10 horse power, that the vehicle will travel 70 miles at an average speed of 12 miles an hour. The feed for such a journey would be 1,500 cubic inches of carbide. The motor is constructed so as to permit of a change from acetylene gas to gasoline.

The cycle and automobile show to be held at Madison Square Garden in New York city during the week of January 22d promises to be a very successful one. It will be given by the National Exhibition company, under the management of Frank W. Sanger. The large amphitheater will be divided into 143 spaces on the main floor, with 81 additional spaces in the gallery. It is reported that there has been an extraordinary demand for space.

The Electric Fire Engine company of America, with a capital stock of $50,000, filed its articles of incorporation in Des Moines, Ia., recently. The incorporators are Theodore Johns, W. B. Shaffer, W. Bishop, John Carmody and C. A. Blomgren. The company proposes to engage in the manufacture of an electric fire engine similar in many respects to the ordinary steam fire engine, except that electricity is used as the power instead of steam. It is so arranged, it is said, that a connection with street-railway or electric-light currents can be made at street corners where hydrant connections are made and the engine started at full pressure instantaneously.

PUBLICATIONS.

The Dearborn Drug and Chemical Works of Chicago, are distributing to their patrons a calendar neatly printed on a celluloid slip in vest-pocket size.

H. B. Willson & Co., Washington, D. C., attorneys and solicitors of American and foreign patents, have published a 40-page circular on "How To Get Patents."

The Wood arc-lamp suspension cutout, manufactured by the Fort Wayne Electric Works, is described in a bulletin just issued. This device is intended to be used with interior arc lights and is manufactured for either constant-potential or series circuits.

The British Columbia Mining Record has issued a handsome Christmas number in magazine form. The cover is printed in colors and bears the coat-of-arms of British Columbia. A number of readable stories and articles of a historical nature are given in the magazine.

The Akron Electrical Manufacturing company of Akron, Ohio, has issued catalogues and separate circulars describing and illustrating its direct-connected and belted dynamos for lighting, power, electroplating, etc., mining locomotives, inclosed motors, switches, switchboards and Packard recording wattmeters.

Thun & Janssen, proprietors of the Textile Machine Works at Reading, Pa., have published, in catalogue form, a treatise on the art of braiding, together with a number of illustrations, specially drawn to show some of the designs that can be produced on their machines. These gentlemen manufacture braiding machines for all purposes, and make a specialty of machines for insulating electrical wires and cables, telephone cords, etc.

The Western Electric company has recently issued Bulletin No. 3003, descriptive of power and lighting machines. It contains illustrations of the different types of belt-connected generators and gives a full description of the general details and construction of the machines. The bulletin gives a complete list of slow-speed multipolar motors from three up to 300 horse power, for 110, 220 and 500 volts. It also gives a list of slow-speed, belt-driven multipolar dynamos, from three to 250 kilowatts.

The B. F. Sturtevant company has issued a bulletin describing its electric propellor fans and enclosed motors for ventilating buildings and rooms of all classes. The fans are manufactured in all sizes, from 18-inch to 120-inch, with capacities from 2,000 to 175,000 cubic feet a minute. The motors, which are sold separately, in sizes from one-sixth to 7½ horse power, are readily portable and are said to be specially adapted for driving small machine tools, blowers, etc. They are entirely enclosed and are capable of continuous operation for 10 hours, with a maximum temperature rise not exceeding 60° Fahrenheit.

POWER TRANSMISSION.

It is asserted that an electrical generating plant is to be established at the Assouan dam, in the Nile, to carry electric current 100 miles to operate cotton factories to be built under British enterprise and with British capital.

The Beckwith estate of Dowagiac, Mich., is said to be making preparations to transmit electric power from Buchanan to Benton Harbor. The estate owns the entire power of the St. Joseph River at Buchanan, only a small portion of which is used. It is claimed that 2,000 horse power can be developed

The Lake George Light, Heat and Power company of Warren County, N. Y., has been incorporated with a capital stock of $50,000 to furnish electricity to Caldwell, Warrensburg and Bolton. The directors of the company are Royal C. Peabody of New York city, Louis W. Emerson of Warrensburg and Frank E. Loughran and A. R. Noble of Caldwell.

Fifteen miles of water rights on Spearfish Creek have been purchased from William Lardner of Deadwood, S. D., by the Cascade Water Power and Electrical Transmission company, which proposes to put in a 15,000 horse power electrical plant to furnish electric power and light to the mines and cities of the Black Hills. The consideration paid for the water right was $100,000.

The incorporation of the Consolidated Electric company has been effected at Manchester, N. H. The capital stock of the new company is $250,000, and its incornorators are Eugene S. Whitney of Manchester, Thomas H. Armstrong of Waltham, Mass., and Arthur E. Mason, Franklin L. Joy, E. W. Kellogg and Frank E. Brown of Boston. The Merrimac River at Garvin's Falls and Hookset will be the scene of operations of the company, and the Manchester street railway, together with many industrial plants, will probably be supplied with light, heat and power.

The Hudson River Water Power company has been incorporated in New York state with a capital of $2,000,000 to manufacture gas for sale in Saratoga Springs and in any town or village not over five miles distant from that village, and manufacture electricity for light, heat and power purposes in cities, towns and villages within the state. The company is authorized to erect and maintain dams across the Hudson River in the counties of Saratoga, Warren and Washington, and elsewhere; also across other streams. The principal office will be in Saratoga Springs. The directors are: Eben H. Gay and Walter H. Trumbull of Boston, Elmer J. West, Charles E. Parsons and E. L. Ashley of Glens Falls.

TELEGRAPH.

A certificate of reduction of the capital stock of the New England Telegraph company of New York city from $280,000 to $50,000 was filed on November 22d. The amount of stock actually paid in is $280,000, and the whole amount of debts and liabilities less than $5,000.

The fiftieth anniversary of the introduction of the electric telegraph in Prussia has been celebrated by the publication of a stately volume by the German imperial postoffice. The publication reviews thor-

oughly the history and present status of the telegraph in the empire.

At a recent meeting of the Colonial Council of Germany, according to the correspondence of the Chicago Record, Director von Bucka announced that the government had come to an agreement with the African Transcontinental Telegraph company, whereby the company was to be permitted to connect the northern and southern sections of the Cape-to-Cairo telegraph line through German East Africa. This is part of Cecil Rhodes' great project, the completion of which will be the paralleling of the telegraph line with a railway. Mr. Beit has conducted the negotiations with the German Colonial Council since Mr. Rhodes left Berlin.

The Western Union Telegraph company announces that hereafter its rate on telegraphic messages between Havana, Cuba, and New York and all other places east of the Mississippi River, and St. Louis and Minneapolis, will be 15 cents a word; and that the rate to all other places west of the Mississippi River will be 20 cents a word. The present rates are respectively 25 and 35 cents a word. The company adds that it has just completed the laying of a new three-conductor cable between Miami, Fla., and Key West, Fla., and a new cable thence to Havana. Contracts for these new cables were under consideration when the Spanish-American war broke out, but were necessarily held over until peace was declared. The company declares that these reductions are in line with its policy to keep its tariffs as low as the traffic warrants.

MISCELLANEOUS.

At the meeting of the Chicago Electrical association on January 5, 1900, H. R. King, of the engineering department of the Western Electric company, will present a paper entitled "Modern Construction of Dynamo-electric Machinery."

The Chicago Trade Press association advocates the establishment by the federal government of a department of commerce and industry. It also recommends that Congress revise the postal laws, providing for a reclassification of mail matter.

The new government printing office at Washington will be eight stories in height and its floor space will be about nine acres. Access to the various floors will be obtained by 12 electric elevators. The building will be lighted with 7,000 incandescent lights. A large crematory will destroy all the refuse material, and this will aid in heating water, etc.

Owing to thefts from a sidewalk showcase the proprietors of a furnishing store on Van Buren street, Chicago, fitted an electric bell in the store and connected it with the showcase so that it would give warning if the case was opened. Shortly after the apparatus had been arranged the bell rang and two youths were caught who had been tampering with the case.

An electrically self-propelling and controllable dredge has been built for the Russian government to be used on the River Volga. The electrical installation consists of two 600-kilowatt generators directly connected to triple-expansion engines. The generators supply eight motors each of 125 horse power driving four-foot screw propellers and also four 30 horse power pontoon motors. Lighting is done from a separate installation, and the control of all motors is centralized in the pilot house. The electric features are said to have added enormously to the effective use of the dredge.

The Engineer of London states that in the electric central stations in that city the boilers in use are divided as follows: Water-tube, 75.5 per cent.; marine, 11 per cent.; Lancashire, 5.5 per cent.; miscellaneous, eight per cent.; while the engines are high-speed, 62.5 per cent.; low-speed vertical, 25 per cent.; low-speed horizontal, 6.25 per cent.; special, 6.25 per cent. Direct coupling is universal.

The Lancet gives a description by F. W. Robinson, M. D., the honorary surgeon of the Huddersfield (England) Infirmary, of a new cranial osteotome, to be worked by an electric motor which he has designed. The apparatus consists of a revolving drill driven by an electric motor, and equipped with the necessary guards so that the depth of cut can be easily adjusted to the thickness of the skull which is being operated on. The device is an ingenious one, as the electric power is transmitted to the drill by a hollow tube, which also carries irrigating antiseptic solution which serves to keep the drill cool and also to remove the bone cut up by the drill.

Announcement is made of the organization of the New York Air Compressor company, under the laws of the state of New Jersey. The capital stock of the company is $100,000, and a complete foundry and machine-shop plant has been purchased at Arlington, N. J. It is intended to manufacture a complete line of air-compressing machinery at the new plant. The officers of the company are: President, J. W. Duntley; vice-president, Alexander Mackay; secretary and treasurer, W. P. Pressinger. In addition to these gentlemen William B. Albright, W. O. Duntley, Thomas Aldcorn and Austin E. Pressinger are directors. The New York office of the company is at 120 Liberty street.

An electrical method of producing water marks in paper, invented by two Englishmen, is thus described: "Upon a platinum sheet or plate forming the positive conducting surface we place a layer of absorbent material, such as blotting paper previously moistened with water. On this material we place the paper which is to receive the water mark, the paper having been previously moistened through with water. We then press, face downward, on the paper a platinum design of the water mark, and this design forms the negative electrode. We keep this negative electrode in contact with the paper for from five to 10 seconds, according to the nature of the paper and the amount of electric current used. The result on removal of the electrode is a distinct and translucent image of the design, which gradually fades as the paper dries, and finally becomes invisible. The mark, however, can be revived and made visible as often as the paper is immersed in water or moistened in any other way."

TRADE NEWS.

Mr. William Jacobs, who recently severed his connection with the H. E. Plass Electric company, has established a business under the name of the Yorkville Electric company, at 26 Vesey street, New York city, where he will continue to manufacture electrical novelties.

Smith, Wallace & Bonta, dealers in electric and street-railway supplies, formerly of Boston, have removed their business to Woburn, Mass., and with a large addition of new machinery and increased space, they announce they are in a position to execute orders with increased promptness.

The stockholders of the Westinghouse Machine company have approved the action of the directors in recommending an increase in the bonded indebtedness of $1,500,000, to be issued as debenture bonds at five per cent. interest. The present capitalization is $3,000,000 and the outstanding indebtedness is $350,000. Part of the new indebtedness will be used to defray the cost of present extensions now nearing completion at East Pittsburg, and about $1,250,000 will be used to erect a large steel foundry just west of the present buildings.

BUSINESS.

The Electric Appliance company, Chicago, reports that if the Packard lamps contracted for on a single contract last month were placed in a line tip to base they would extend 6⅛ miles.

The new courthouse at Baltimore, Md., said to be one of the finest structures of its kind in the country, is expected to be finished by January 1, 1900. The building is to be lighted by electricity, and 120 Holophane glass globes will be used with the fixtures.

The Chicago Edison company reports a large increase in the sales of its supply department over preceding years. The company is carrying a full line of electric-lighting supplies and is preparing for an even greater extension of its business in this line during the coming year.

Williamson & Co. of Cleveland, Ohio, have placed a contract with the Western Electric company for three 100-kilowatt, 125-volt, direct-connected generators, to be installed in the Williamson building. These machines will be direct connected to Ball engines, and will be installed by the construction department of the Western Electric company.

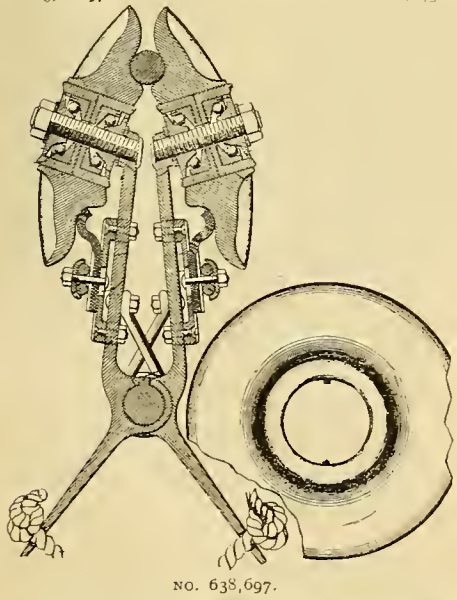
The new addition to the works of the B. F. Sturtevant company, Boston, Mass., which was designed to meet the requirements of its rapidly growing electrical department, is said to be already overcrowded, although completed only a few months ago. Numerous special orders for electric fans and generating sets for the Navy Department are being filled by the company, and the construction of a complete line of enclosed motors, of new design, is now under way.

The increasing use of carbon brushes is shown by the growing demand for the Temple carbon-brush holder, which is designed to facilitate the use of copper brushes on dynamos and motors. Among other large lighting plants recently equipped with this device is that of the Stock Exchange building at Chicago, using 16 brush holders on three 100-kilowatt machines, and the plant of Swift & Co. at St. Joseph, Mo. The Temple brush holder is manufactured by the Clay Electric and Manufacturing company of Chicago, which will furnish descriptive circulars and testimonials on request.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 12, 1899.

638,687. Electric Switch. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston, Mass. Application filed December 23, 1897.



NO. 638,697.

The switch has an eccentrically mounted movable member, a pivoted actuating carrier, means to connect them comprising connected curved slots of substantially the same radius but having different centers in one member, and a bar or projection rigidly attached to the other member, and a yielding medium actuated by the independent movement of the carrier.

638,692. Manhole for Electric Conduits. James Banwell, Cleveland, O., assignor of three-fourths to C. W. Nokes and William H. Risley, Cleveland, O. Application filed July 19, 1899.

The manhole comprises an upper and a lower section, the upper section having a series of inclines about its lower edge and corresponding inclines within the lower section on which the upper section is adjustably supported.

638,697. Trolley. George W. Bolser, Lockland, O. Application filed December 19, 1898.

In the trolley are combined an angular pivotal post having one arm attached to a trolley pole, a sectional trolley head having its members mounted on the other arm of the post, a spring coiled on the post and attached at its respective ends to the members of the trolley head, and shoes mounted on the members in position to grip an intermediate conductor. (See cut.)

638,703. Electric Arc Lamp. Walter J. Cochran, Le Roy, N. Y., assignor to David J. Bissell, Le Roy, N. Y. Application filed January 23, 1899.

The lamp has diagonally converging tubes fixed to its frame, gravity-fed carbons sliding in the tubes, in combination with an arc-maintaining and pick-up device comprising an armature, pivoted clutches directly engaging the carbons and gripping the carbons on the attracted movement of the armature, and laterally yielding connections between the armature and clutches, whereby the carbons are picked up in the direction of their axes and at the same time separated. (See cut.)

638,705. Electric Switch. John L. Creveling, New York, N. Y. Application filed January 24, 1899.

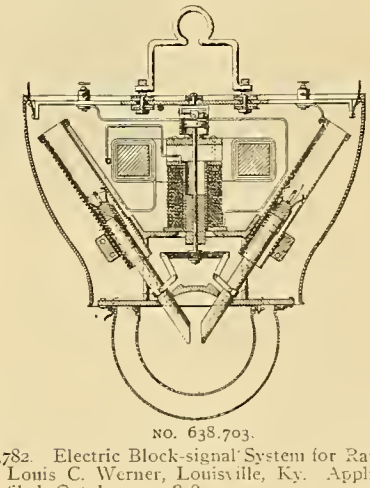
The switch has tubular contact studs uniting a base and plate, a hub pivotally mounted in the base, and contact-making members working upon opposite sides of the plate.

638,753. Electric Gas Lighter. Frederick N. Pike, New York, N. Y., assignor of one-third to Edward N. Dickerson, New York, N. Y. Application filed February 16, 1897.

A pivoted electrode is adapted to make contact with stationary electrode and then to be returned to its first position by the action of gravity.

638,754. Electric Gas Lighter. Frederick N. Pike, New York, N. Y., assignor of one-third to Edward N. Dickerson, New York, N. Y. Application filed February 16, 1897.

This invention is similar in construction to the one above.



NO. 638,703.

638,782. Electric Block-signal System for Railways. Louis C. Werner, Louisville, Ky. Application filed October 7, 1898.

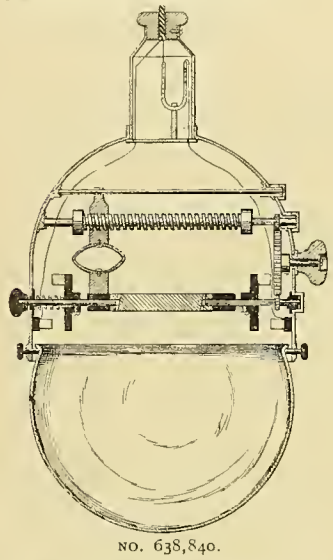
An automatic block-signal system is described. It combines with a track having a sectional conductor forming insulated blocks, a vehicle movable along the track, a semaphore controlling a block circuit and a pair of successively operative electrical registers both controlled by the block circuit.

638,788. Electric Arc Lamp. Ernst Woltmann, New York, N. Y., assignor of one-half to Albert Anderson and Johan M. Andersen, Boston, Mass. Application filed October 25, 1898.

Combined in the lamp are an electromagnet, a clutch constructed to engage and lift one of the lamp carbons and to permit its movement while the lamp is in operation, a rod connected to the clutch, and means acting on the rod to lift the carbon, the means being substantially inactive upon the carbon while the armature of the electromagnet is being attracted, and becoming fully active to move the carbon for substantially the entire range of its movement after the armature is in its attracted position.

638,789. Electric Arc Lamp. James J. Wood, Fort Wayne, Ind., assignor to the General Electric company of New York. Application filed August 25, 1898.

There is described an arc lamp for alternating currents, which combines with the feed mechanism and regulating magnet, a yielding medium interposed between the movable member of the magnet and the feed mechanism, adapted to communicate the bodily movements of the member while suppressing the communication of its vibration, and consisting of a spring arranged to exert stress perpendicularly to the direction of motion.



NO. 638,840.

638,833. Electric-light Socket. Leo M. Chapman and James M. Gelatt, Louisville, Ky. Application filed May 6, 1899.

The socket has a detachable shaft passing through its casing which is provided with a detachable block arranged to operate in connection with contact devices.

638,836. Electric Arc Lamp. William J. Davy and George Thomas-Davies, London, England. Application filed June 6, 1898.

An inclosed arc lamp is described. It consists of a closed mechanism chamber, a central frame tube fixed to and entering into the chamber, an inclosing bell supported from the chamber and a carbon holder sliding in the frame tube and operatively connected to the exterior controlling devices through a link working in a snugly fitting aperture in a plug closing the frame tube.

638,837. Pencil for Incandescent Lamps. Reginald A. Fessenden, Allegheny, Pa., assignor of one-half to Grant McCargo, Pittsburg, Pa. Application filed August 25, 1899.

The pencil has its body portion formed of a material which will be conductive only when heated, and its end portions formed of a material which becomes conductive at a lower temperature than the body portion.

638,838. Pencil for Incandescent Lamps. Reginald A. Fessenden, Allegheny, Pa., assignor of one-half to Grant McCargo, Pittsburg, Pa. Application filed August 25, 1899.

This pencil consists of a body portion conductive only when heated, intermediate of portions conductive at a lower temperature than the body portion, and provided with terminals formed of graphite.

638,839. Incandescent Lamp. Reginald A. Fessenden, Allegheny, Pa., assignor of one-half to Grant McCargo, Pittsburg, Pa. Application filed August 25, 1899.

The lamp combines a pencil non-conductive at low temperatures, but conductive at high temperatures, a carrier for a conducting material neutralizable at high temperatures, and means for causing the carrier to move along the pencil.

638,840. Incandescent Lamp. Reginald A. Fessenden, Allegheny, Pa., assignor of one-half to Grant McCargo, Pittsburg, Pa. Application filed August 25, 1899.

In the lamp are combined a pencil or body adapted to be highly heated by the passage of an electric current, and a resistance automatically increasable to an abnormal extent by a slight increase of current above the normal, connected in series with the pencil. (See cut.)

638,859. Switch for Electrically Propelled Vehicles. Paul H. White, Indianapolis, Ind., assignor to Charles F. Smith, Indianapolis, Ind. Application filed May 15, 1899.

An electrically driven vehicle having storage batteries and suitable contacts is provided with other contacts mounted on an adjacent portion of the vehicle body, and a rock shaft provided with wings adapted as the shaft is rocked to engage with the contacts and thus electrically connect or disconnect the batteries.

638,872. Multipolar Electric Motor. Charles A. Lindstrom, Chicago, Ill. Application filed October 16, 1899.

The machine combines a field ring, field magnets, field-magnet coils, blocks of non-conducting material placed between the adjacent ends of the coils, and a radially disposed non-magnetic member adjustably connecting the blocks to the field ring.

638,874. Supporting Device for Battery Electrodes and Cups. Roderick Macrae, Baltimore, Md., assignor of one-half to William C. L. Eglin, Philadelphia, Pa. Application filed April 8, 1899.

Supporting devices operating to independently and removably connect and support the battery elements and their jars or cups are described.

638,893. Electro-mechanical Indicating and Recording Apparatus. Charles E. Vernon, London, and Arthur Ross, Sutton, England. Application filed December 24, 1897.

There is described a weight or pressure-indicating apparatus for transmitting from distant points to a central station indications of weight or pressure, which combines a source of electric energy, an electromagnetic testing device at each distant point, circuits connecting the source of energy with the testing devices, a variable resistance rheostat in circuit with the testing devices, annunciators, contacts on the testing devices, leads connecting those contacts and the annunciators with a source of energy, a signal device and electromagnetic locking device shunted across the testing-device circuit, and signal contacts on the testing device for automatically forming or breaking the continuity of this shunt circuit. (See cut.)

638,895. Electrical Tree. George H. Wallis, San Francisco, Cal., assignor to the Washburn & Moen Manufacturing company, Worcester, Mass. Application filed September 21, 1899.

The invention comprises a body formed of submarine or similar cable, branches formed by untwisting wires of the cable and extending them outwardly from the body, electric lights fixed to the branches, and circuit wires through which the current is supplied thereto. (See cut.)

638,901. Magnetic Actuator. Daniel Bacon, New York, N. Y., assignor to himself and A. G. Wheeler, Jr., trustees, New York, N. Y. Application filed February 24, 1899.

The device is adapted to be interposed between the source of power and the mechanism to be driven thereby, and comprises magnets normally revolving in opposite directions and transmitting power to the apparatus to be actuated, and means for revolving the magnets simultaneously in opposite directions.

638,917. Process of Producing Wire Bars. Elisha Emerson, Providence, R. I. Application filed May 4, 1899.

The process consists in winding a flat strip of electro-deposited metal into a spiral having the broad sides of the strip practically at right angles to the axis of the spiral to form a cathode, supporting the cathode in a tank and depositing additional metal on the spiral strip by electro-deposition.

638,933. Electric Generator for Gas-engine Igniters. Benjamin McInnerney, Omaha, Neb., assignor to the McInnerney Manufacturing company, Omaha, Neb. Application filed June 10, 1899.

The generator has a permanent magnet with laminated wire-wound poles and a keeper, and means for carrying one past the other to first reduce the magnetic flux and then increase it suddenly to a maximum.

638,966. Electrically Propelled Vehicle. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car company of America, Philadelphia, Pa. Application filed October 27, 1886.

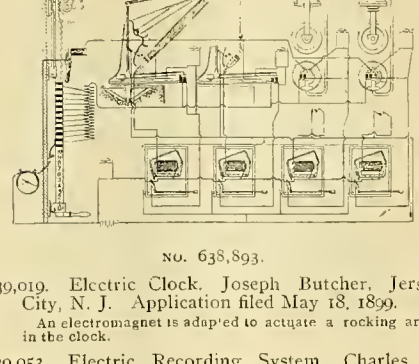
Two working conductors arranged parallel to the track and independent thereof, two or more trucks each provided with an electric motor, and other trucks provided with positive and negative collectors independent of the supporting or truck wheels working in contact are combined with the working conductors, electric circuits common to all of the motors on the different trucks, and receiving current from the various collectors, and a car body supported upon the trucks.

638,986. Target. Emil F. G. Pein, Hamburg, Germany. Application filed June 26, 1899.

Combined with a target composed of independently yielding sections and a registering dial located apart therefrom are normally open scoring circuits of varying resistances, one for each section, for operating the dial, and means brought into action by the yielding of the individual sections whereby the scoring circuits appertaining thereto are closed.

638,992. Indicator for Elevators. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing company, Chicago, Ill. Application filed February 10, 1898.

To the indicator are an electric signal arranged at each landing, a circuit for each signal, pivoted levers normally out of electrical connection with each other and arranged in the circuit of each signal, means for establishing electrical connection between each pair of levers, and means actuated coincidently with the travel of the car for actuating the circuit-establishing means.



NO. 638,893.

639,019. Electric Clock. Joseph Butcher, Jersey City, N. J. Application filed May 18, 1899.

An electromagnet is adapted to actuate a rocking arbor in the clock.

639,053. Electric Recording System. Charles L. Jaeger, Maywood, N. J. Application filed February 8, 1898.

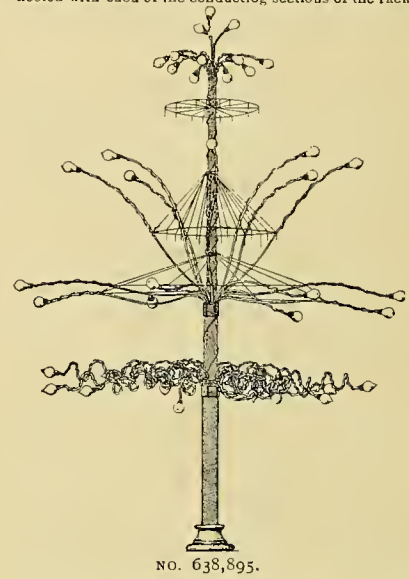
An instrument is described which combines a curved recording conductor, a conductor arranged adjacent to the curved conductor, an electromagnet arranged in line with the axis of the needle, a chronometer provided with a circuit-closer actuated at predetermined intervals and placed in circuit with the electromagnet, means operated by the electromagnet for moving a paper between the two conductors, and means for causing the passing of sparks between the two conductors.

639,062. Electromagnetic Apparatus for Separating Ores. Emil Kreuser, Mechernich, Germany. Original application filed February 28, 1899. Divided and this application filed May 12, 1899.

The separator consists of a pair of cylindrical electromagnets having at least three cylindrical poles of larger diameter than the intermediate parts on which the wire coils are wound, the two end poles being of the same polarity while the intermediate pole is of opposite polarity, and one of the sets of poles being made of larger diameter than the other, so that such larger poles of one magnet are in contact with those of the other, while the polar distance between the smaller poles constitutes the magnetic field for the separation of the ores.

639,124. Electric Alarm or Signal. Henry Wild, Johnstown, Pa. Application filed October 7, 1899.

There is described a mechanism which combines a rotatable arm, a rack arranged concentric with the axis about which the arm moves and consisting of alternately arranged sections of conducting and non-conducting material, a pinion carried by the rotatable arm and meshing with the rack, and an electric circuit including a signal device, having one terminal electrically connected with the rotatable arm and its other terminal electrically connected with each of the conducting sections of the rack.



NO. 638,895.

639,127. Switch for Electric Traction Systems. Otto Zoedicke, Mühlhausen, Germany. Application filed August 28, 1899.

The switch comprises three fixed conductors and intermediate spring-controlled switch tongues with oppositely arranged pivotal points in combination with guide plates having inwardly turned edges adapted to engage with the axle or studs on the trolley when the latter passes in order to prevent the jumping off of the roller from the tongues at the switching points.

639,161. Incandescent Lamp. Reginald A. Fessenden, Allegheny, Pa., assignor of one-half to Grant McCargo, Pittsburg, Pa. Application filed August 7, 1899.

The lamp has a pencil or rod formed of a material non-conductive at low temperatures but conductive at high temperatures, terminals formed of conducting material, a conductor neutralizable at high temperatures for connecting the terminals and arranged in such relation to the pencil or rod as to heat the rod on the passage of a current to a conducting temperature, and mechanism for renewing the conductor from time to time.

639,170. Means for Controlling Electric Heaters. Edward E. Gold, New York, N. Y. Application filed March 10, 1897.

The inventor describes a rotary switch for controlling electric heaters which is movable to a plurality of positions by equal fractions of a complete revolution.

639,186. System of Automatic-telephone Exchanges. Gustave Seligmann-Lui, Paris, France, assignor to the Automatic Telephone company, Limited, London, England. Application filed May 27, 1898.

See illustrated descript on on page 370.

639,195. Electric Switch. William Ely, Providence, R. I. Application filed March 14, 1899.

The switch has opposite sets of circuit terminals in combination with a contact member for engagement with the circuit terminals, means for the primary storage of sufficient energy for causing the automatic transfer of the contact member from one set of circuit terminals to the opposite set, and means for intercepting the contact member in its flight, at the will of the operator, and holding it in its intercepted position.

639,202. Signaling System and Apparatus for Electric-trolley Railways. Wesley R. Stearns, Portland, Ore., assignor of one-third to William Dent, Portland, Ore. Application filed July 30, 1898.

In the system are provided electric signals, a circuit-making and breaking device electrically connected with the circuit operating the signals, a trip adapted to operate the device, and means controlled by a pneumatic device for retaining the circuit-making and breaking device in the position given it by being operated by the trip for about the interval required for the air admitted into the pneumatic device to escape again.

REISSUE.

11,794. Electric Switch. John E. Sayles, Montclair, N. J., and Henry E. Reeve, New York, N. Y. Application filed October 10, 1899. Original No. 630,076, dated August 1, 1899.

The switch comprises a sheet-metal base having stiffening flanges and retaining lugs struck up therefrom, an insulating block secured to the base and centered between the lugs, the block having contacts thereon, and a switch lever pivoted upon the base.

Western Electrician.
EVERY SATURDAY.
Vol. XXV. CHICAGO, DECEMBER 30, 1899. No. 27

Light, Heat and Power Supply in the Cable Building.

One of the most attractive of the new steel structures in the downtown portion of Chicago is the Cable building, built for the Cable Piano company, at the southeast corner of Wabash avenue and Jackson boulevard. The architects, Holabird & Roche, have adopted a light-brown terra-cotta facing for the outside of the building, the tile being arranged so as to form a pleasing design and making an attractive exterior to the building. The first five floors and the basement are occupied by the Cable Piano company for its downtown salesrooms. The five floors above are laid out for studios and miscellaneous offices.

After considering the comparative merits of the different means for providing electric current for the building, the architects and owners decided to adopt the central-station service of the Chicago Edison company, and this service is relied upon exclusively, the building being wired upon the straight Edison three-wire system, designed solely for use with Edison central-station service.

The power from the street service not only provides for the arc and incandescent lighting, but also runs the elevators, house pump and the surface-drainage pump.

The heating is supplied by two moderate-sized tubular boilers 56 inches in diameter and 16 feet in length. These boilers use soft coal as fuel and generate steam at 25 to 40 pounds' pressure. This pressure is reduced by a regulating valve to about four pounds, the pressure maintained throughout the heating system. Boilers of this steam pressure were selected so that soft coal could be used in connection with smoke consumers, and so that a greater boiler capacity could be installed than would have been practicable with low-pressure boilers. The one-pipe overhead system of heating is employed in the building, a four-by-six-by-six-inch Blake steam pump being placed in the basement to pump the condensation from the system into the boilers, and also to furnish the boilers with additional feed water.

The water for the hot-water service of the building is heated by a steam coil in a tank 42 inches in diameter and eight feet long. The return from this system is collected in a receiving tank under the hot-water heater, from which it is pumped into the boilers. When the boilers are not used during warm weather, hot water is provided by a Wilkes heater placed in a corner of the pump and elevator-machinery room.

The cold-water service is supplied by a Quimby electric pump, shown at the left in the foreground of Fig. 1. This pump operates on the balanced-screw principle. It is driven by a direct-connected one horse power Sprague series-wound electric motor operating at a speed of 1,000 revolutions per minute. The pump is automatic in operation, is noiseless and requires but little attention. The water is pumped to a large tank on the roof, from which the service for the building is supplied. The automatic control is secured by means of a float in the tank, which operates a Zimdars & Hunt automatic switch in the basement. This switch starts the motor when the water has been drawn from the tank, and cuts off the current from the motor when the tank has been filled. The water is propelled through the pump by four screws, the action being perfectly continuous, thus doing away with all pulsation and water-hammer effect in the delivery pipes. The noiseless operation of the pump itself is secured by reason of its being direct-connected to the motor, and because it has no valves or internal packing to produce noise through wear. The efficiency of this pump is said to be equal to that of the best triplex pump. At 220 volts' pressure the motor uses but 2½ or three amperes of current, the cost of running being about $2 a month. The pump has a capacity of 1,000 gallons an hour, and is cross-connected with the steam pump, so that it can be used for feeding the boilers when necessary.

A Yeomans electric pump, shown in the center of Fig. 1, is used to lift the sub-drainage of the basement into the city sewerage. This drainage is collected in the catch-basin under the bilge pump (Fig. 2, on next page) and is raised to the desired level by a rotary pump direct-connected to an iron-clad two horse power vertical motor of a type manufactured by the Milwaukee Electric company on special designs furnished by the pump manufacturer. The speed of the motor is 550 revolutions per minute. The pump and motor are automatically controlled by a switch similar to the one used in connection with the house-service pump. This pump also operates noiselessly and cannot become clogged. It has a capacity of 75 gallons a minute and the cost of operation does not exceed $1 a month. Both of the electric pumps were installed by Edward Yeomans of Chicago.

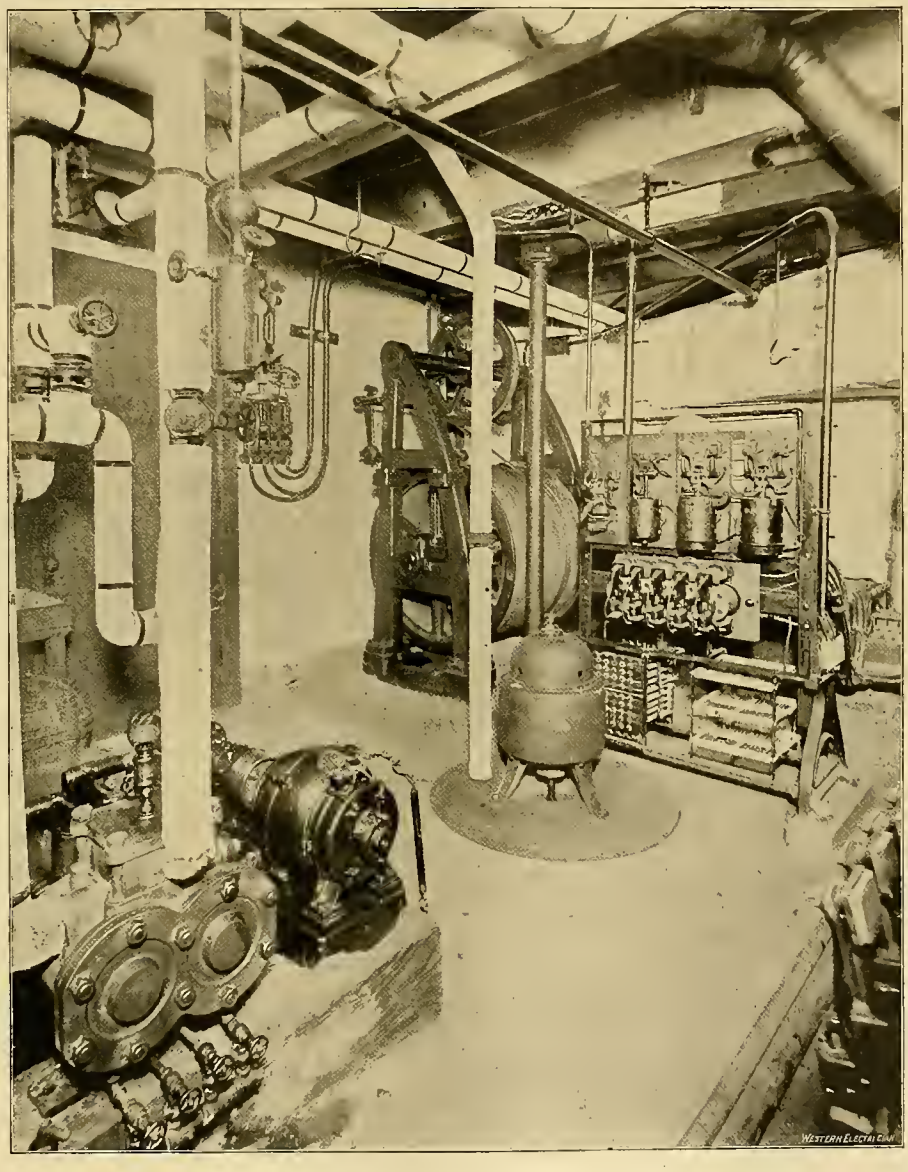


FIG. 1. LIGHT, HEAT AND POWER SUPPLY IN THE CABLE BUILDING.—PUMP AND ELEVATOR ROOM.

The compact arrangement of the boilers, pumps and elevator mechanisms is shown in Fig. 2, which represents a portion of the basement plan of the building. The larger part of the basement is not utilized for mechanical purposes at all, but is at the disposal of the tenants, and is used as a piano salesroom. The space devoted to the boilers, coal bins, pumps, hot-water tanks, two elevator mechanisms, etc., is only 1,155 square feet, which is less than one-fifth of the area of the basement. The illustration on this page is a reproduction of a photograph of the pump and elevator room. The Quimby pump driven by the Sprague motor is seen at the left in the foreground. One of the elevator machines, with its magnet-control board, is shown in the background, and directly in front of the board is seen the bilge-pump motor.

The mechanisms for two electric passenger elevators are located in this room. They are of the Otis type and are guaranteed to lift a weight of 2,000 pounds at a speed of 300 feet a minute. The worm of each elevator machine is driven by a 25 horse power electric motor, operating at a speed of 800 revolutions a minute. Each elevator is controlled by the Otis magnet control. This controlling apparatus is mounted on an iron frame. One of these frames is shown in Fig. 1. At the top are a circuit-breaker and three electro-magnetic control devices, each mounted on a brown-slate slab. Each elevator has a fast and an intermediate speed. The electromagnet on the right controls the descent of the elevator, the next one the ascent, both at the intermediate speed, and the third controls the fast speed in both directions. Below are mounted five contacts, which cut out the resistance of the motor circuit at the starting of the motor. The resistance coils are placed at the bottom of the frame. On the back of the board are the electromagnetic switches which control the brake of the elevator. A freight elevator running to the basement is operated by similar mechanism, placed in a room on the south side of the basement, as indicated on the plan in Fig. 2.

The electric lighting of the building includes 28 arc lights of 2,000 candle power each and about 600 16 candle power incandescent lights. About 250 10 candle power incandescent lamps are used in an illuminated sign at the corner of the building.

Starting from the Edison service on Jackson boulevard, a set of three-wire mains is carried up to the fifth floor, providing service exclusively for the five floors and basement occupied by the Cable Piano company. A second set, carried to the tenth floor, provides for the offices and studios on the five upper floors. A third and smaller set of mains is carried to the tenth floor, providing for the halls and public lights of the building.

The mains in the basement are run in iron-armored conduit, but in passing up, from floor to floor, they are run on porcelain insulators in a shaft especially provided for this purpose. In one sense, however, this is not a shaft, as the space on every floor is completely separated from the space on the next floor, the mains passing through the floor encased in porcelain tubes. This shaft is built of tile in accordance with the construction of the building, and the door opening into it on each floor is lined

with fireproof material. This forms practically a closet, in which the meters are placed above and the cutout boards below. These cutout boards are made of polished slate, and on them are mounted standard Edison porcelain plug-fuse cutouts.

The tap-line wiring throughout the building consists of Simplex caoutchouc duplex wire run in iron-armored conduit. This conduit is so installed that there are no sharp bends or angles. The wires were all drawn in after the plaster was laid; hence, at any future time, new wires can be installed, if necessary; in fact, the entire building can be rewired without disturbing the walls or decorations. Notwithstanding the increased cost in iron-conduit construction, this is now considered the most approved method of interior wiring; it does away entirely with the old necessity of constant testing for grounds during the construction of a building. Whether laid in the floors or walls, these conduits afford ample protection from carpenters' nails, plasterers' trowels and the various disturbances caused by the succession of one set of contractors after another; and, at the same time, they provide a dry and insulated raceway, affording additional protection in case the wire should ever deteriorate. When the use of iron-armored conduit was first adopted there was difficulty with respect to alternating currents, inasmuch as they would produce an induced current in the iron pipe. To counteract this effect duplex wire was adopted, so that the induction from one wire counteracts the induction of the other wire in the circuit. This construction has become standard for all classes of iron-conduit work, both for direct and alternating currents. No difficulty has been experienced from any tendency toward short-circuiting of the wires.

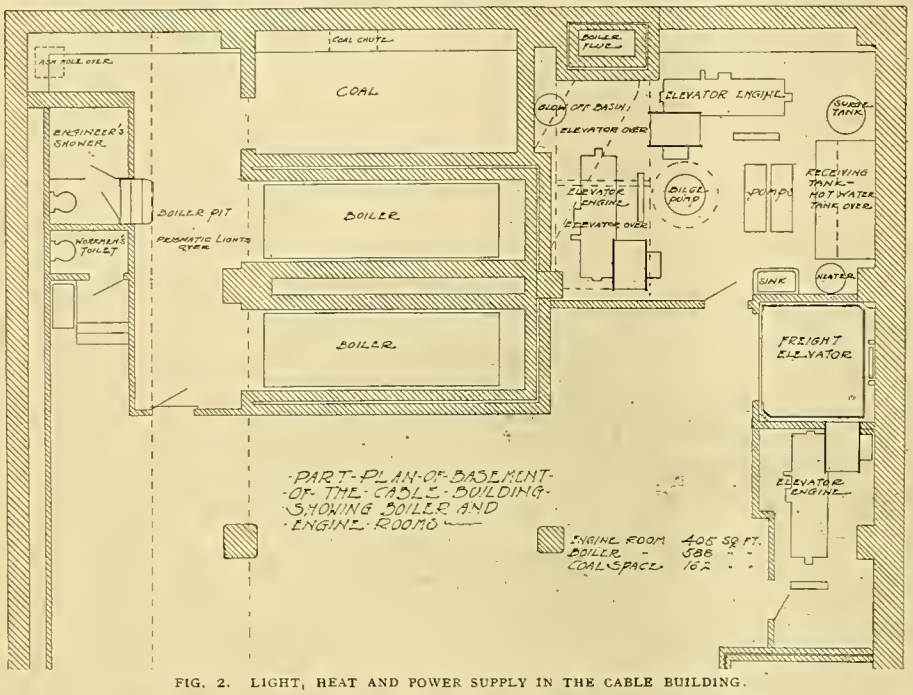


FIG. 2. LIGHT, HEAT AND POWER SUPPLY IN THE CABLE BUILDING.

Throughout the building Hart flush switches, with Bauer-Barff finish, are used, and where switches are grouped they are arranged under a neat combination plate. The hall lights are controlled by lock switches, the key to which is kept by the janitor or some authorized person.

In the offices and upper floors incandescent lights are used exclusively, while in the salesrooms of the Cable company the lighting is done principally by means of arc lamps. These are the standard long-life Bergmann lamps, and their polished brass cases contrast very handsomely with the cream tint on the walls.

The wiring is so arranged that separate meters are provided for each office and studio, for the hall and public lights, and for the lights used by the piano company. The wiring for both arc and incandescent lighting and for power was installed by the construction department of the Chicago Edison company.

Havana Street Railways Combined.

On December 22d action was taken which will result in the consolidation of all the street-railway interests in the city of Havana. By this action, it is expected that a contest begun some time ago between the Harvey syndicate and the American Indies company, the two leading interests involved, is ended. The new board of directors of the Havana Electric Railway company, which now owns all the franchises in the Cuban capital, is as follows: President, Edwin Hanson; vice-presidents, William L. Bull and R. A. C. Smith; secretary and treasurer, Arnold Marcus; directors (in addition to those above named), P. A. B. Widener, Thomas F. Ryan, Sir William Van Horne, William McKenzie, Frederick Nichols, H. M. Perkins, Thomas P. Fowler, E. H. Andreni, William M. Doull, N. Gelats and G. B. M. Harvey. The capitalization of the company remains unchanged, namely, $5,000,000 of preferred stock, $5,000,000 of common stock and a first mortgage, representing $5,000,000 of five per cent., 50-year bonds. The entire system, consisting of about 50 miles of track, will be electrically operated, and work on the power house is to begin at once.

Shall Imported Electricity Bear a Customs Duty?

Washington, D. C., December 23.—The attention of the Treasury Department officials has been called to the rapid and aggressive movements that are being made on the American side by the Ontario Power company of Niagara Falls, Canada, in the extension of its lines in this country. And the question of levying a tariff duty upon the transactions of that company is raising quite a commotion, although it is not the first time that such a question has come up for consideration. The case in question dates back for some little time, when, several years ago, a letter was received by the department from a citizen of Watertown, N. Y., in which he stated that he had obtained a concession to build and operate an electric power plant on the Canadian side of the Niagara Falls, and asked if, in the event that he transmitted the current across the border, he would be compelled to pay tariff charges. Assistant Secretary of the Treasury Tichenor assured him at that time that no tariff charges would be assessed.

So far as that was concerned it was all satisfactory to the persons interested, but the matter has been again brought to the attention of the department, and this time by the Niagara Falls Power company of Niagara Falls, N. Y., which makes the claim that, inasmuch as the electric current is a thing of value bought and sold, and since it comes into actual competition with an American industry, by reason of the extension of the lines of the Canadian company to as many points as possible in the United States, and the selling of its light and power to as many customers as it can get, that it should be made subject to duty.

The Treasury Department is at the present time disposed to take a different view of the matter from what it did at the time when a reply was made to the Watertown correspondent, and it is strongly inclined to the idea that a duty should be assessed. The secretary of the treasury has submitted the question to several leading collectors of customs in various ports of the country, with a view of securing their ideas on the subject. If it is decided that the electric current should be assessed it would be at 20 per cent. ad valorem, under the paragraph for unenumerated manufactured articles.

Some years ago a similar measure was proposed in connection with natural gas piped across from the Canadian side, but it was upset by the decision of the board of general appraisers, which maintained that gas was not an "article," which decision was upheld by the Supreme Court of the United States; and the government is now refunding money to the gas company on duties that were assessed on natural gas by a collector during the early part of the present year. The Canadian Power company also makes the claim that an electric current cannot be regarded as an "article" as within the meaning of the tariff law, despite the representation of the Niagara Falls Power company to the effect that electricity is a thing that can be measured as accurately as potatoes or any other like commodity. A. F. T.

The proposed extension of the Portsmouth (N. H.) street-railway system to Hampton Beach, through Rye, was begun recently. It will connect the city with the two beaches to the south. A line to York Beach was established from Portsmouth about two years ago.

Three-phase, 3,500-kilowatt Unit for Metropolitan Station in New York.

Next to the 5,000-kilowatt machines ordered for the Manhattan Railway company's plant in New York, the illustration shows a type of the largest steam-driven dynamos in the world. It represents one of the 3,500-kilowatt (6,600 volts) three-phase alternating-current generators which have been supplied by the General Electric company for the station of the Metropolitan Street Railway company of New York.

This generator has 40 poles and is of the revolving-field type. The speed is 75 revolutions a minute, and the frequency 25 cycles a second. The field of the generator is mounted directly on the engine shaft. The armature core is built up of sheet-iron punchings of high permeability and low hysteresis, well japanned before assembling, and further insulated from one another by sheets of paper inserted at intervals to reduce the eddy-current losses. The windings are in slots on the inner side, the teeth of the core being recessed for the insertion of wooden wedges to hold the windings firmly in place. The punchings are assembled with ventilating spaces between, thus allowing free circulation of air in direct contact with the cores and windings. The coils forming the windings are completely insulated before being placed in the machine, the coils being so arranged that any one can be taken out by removing a few adjacent ones, and, in case of a burn-out, the defective coil can be readily taken out and another put in its place.

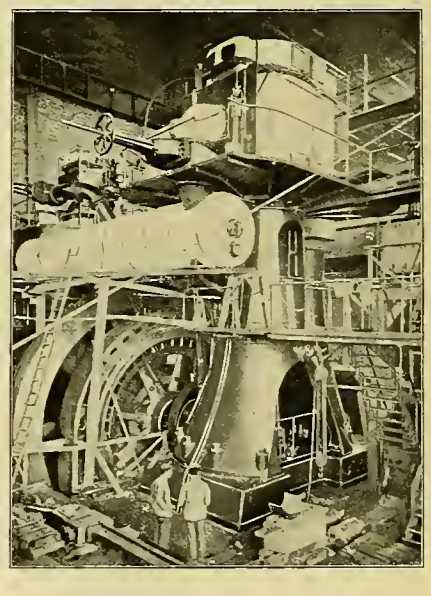
The outside frame of the armature is of cast-iron, supported on slide rails, so that it may be moved to one side clear of the revolving field to facilitate inspection or repair.

The magnet frame consists of a cast-steel ring with outwardly projecting poles of sheet-iron bolted to the steel ring, the ring being mounted on a substantial cast-iron spider.

The field coils consist of copper strip wound on edge and are insulated to stand a high-potential test of 4,000 volts alternating between the winding and core. The excitation electromotive force is 125 volts. The armature windings were tested to 15,000 volts alternating.

The exciting collectors consist of two insulated rings supported on the shaft, carbon brushes being used. The over-all width at right angles to the shaft is 22 feet six inches. The over-all width of magnet frame parallel with the shaft is 51 inches; the diameter of engine shaft is 37 inches, and the diameter of field, 16 feet nine inches.

The engine, made by the Edward P. Allis company of Milwaukee, has these dimensions: Cylinders, 46 inches and 92 inches diameter; stroke, 60 inches. The total weight of the engine is approximately 625 tons. The flywheel is 28 feet in diameter, constructed in 10 segments, and weighs, approximately, 100 tons. The crankshaft weighs 41 tons. The engines are designed to consume 13 pounds of steam per indicated horse power per hour.



THREE-PHASE 3,500-KILOWATT UNIT.

The illustration is reproduced from the Electrical Review of London, which obtained it from the British Thomson-Houston company.

Chicago Automobile Club.

The Automobile Club of Chicago has been incorporated by J. Ogden Armour, Samuel Insull, F. K. Fulsifer, E. Walter Herrick and Andrew R. Sheriff. The object of the club will be primarily social, but all matters connected with the protection of automobile driving and the development of the sport will be given attention. It is the plan also to provide for an occasional automobile race. In time the incorporators expect to build a clubhouse of their own. Paris and New York already have clubs of this kind.

Telegraph and Telephone Bills in Congress.

On the 15th of August, 1876, an act was passed by Congress granting to Celso Cæsar Moreno and certain associates the right to construct and operate a line or lines of telegraph or submarine cable on the Pacific coast, in order to connect the America and the Asiatic coasts by way of the Hawaiian Islands, Japan and China. Since that time many of the persons who were associated with Moreno have died, and now a bill has been introduced for the revival of the privileges of the old act, the project to be actively commenced within three years from date of act causing such revival. The next bill introduced was for the formation of the Pacific Cable Commission, to consist of the postmaster-general, the chief signal officer of the army and three other members, to be appointed by the president, and one of them to be an engineer. The term of office of the original members is to be one, two and three years; their successors are to be appointed for three years' service. Compensation, mileage and expenses are to be the same as those paid to the Nicaragua Canal Commission and reports are to be made to the president annually. The purpose of the formation of such a commission is to construct, operate and maintain a submarine cable or cables and connecting land lines between San Francisco, Honolulu, Manila, by a route suggested in the bill or any other that may be deemed more practical by the commission. All contracts are to be advertised, and to be awarded to the lowest responsible bidders. The cables must be of first-class material, capable of transmitting not less than 130 letters a minute; they must be of American manufacture, laid and maintained by American ships, unless it be found that it is impossible to secure cable of such manufacture within a year after the award is made, in which case deficiencies may be made up in foreign markets. An immediate appropriation is asked of $500,000, the total appropriation not to exceed $8,000,000. This is the Corliss bill in the House, already referred to in the Western Electrician. There is also the bill noted in this journal last week for the construction of a Pacific cable, to be built under the direction of the Navy Department, and to be turned over to the postmaster-general when completed, to be operated under his control. The appropriation asked for this project is $11,000,000.

A bill has been introduced for the purpose of making the telegraphic companies pay the one-cent tax on all messages, a failure to do so subjecting the offender to a penalty of $200.

The old measure for the establishment of a governmental telegraph system has been revived, the control to be lodged in the secretaries of state and war and the postmaster-general, the system to consist of four trunk lines, and the central point to be at Washington. For this purpose an appropriation of $5,000,000 is asked.

Another bill for the establishment of a postal telegraph and telephone system, to be carried on in connection with the Postoffice Department and under the control of the postmaster-general, has been introduced by Senator Butler. For the purpose of carrying out the enterprise the sum of $25,000,000 is asked.

Senator Pettigrew has introduced a bill authorizing the postmaster-general to secure, for the use and benefit of the United States, the right to use any new method of rapid telegraphing by the use of alternating currents, or otherwise, which has been developed by Professor Crehore and Lieutenant George Owen Squier or others. For the purpose of experimenting with these systems the postmaster-general is authorized to construct a trial line between Washington and New York, and for this purpose $1,000,000 is asked.

Representative Joy has introduced a bill to grant the right to the United States and West Indies Direct Telegraph company to lay and operate cables between the United States, Cuba, Porto Rico and such other of the West Indies Islands as the United States may have control of. No responsibility is to be assumed by the United States.

A rival telegraph and telephone company for the District of Columbia is seeking right-of-way, under the name of the Washington Telephone and Telegraph company.

The Commercial Cable company of Cuba is asking for a permit to lay and operate a cable between the United States and Cuba, subject to the usual conditions.

Senator Butler has introduced a bill for a submarine Pacific cable, to be constructed by the government, the same to be equal to and superior, if possible, of any cable at present in operation or under course of construction. The sum considered necessary for this undertaking is $10,000,000.

Senator Lodge has introduced a bill to provide for the establishment of a contract with some American cable company, at a sum of $400,000, payable quarterly, for 20 years, for the electrical transmission of messages between the United States, Hawaii, Philippine Islands, Japan and China.

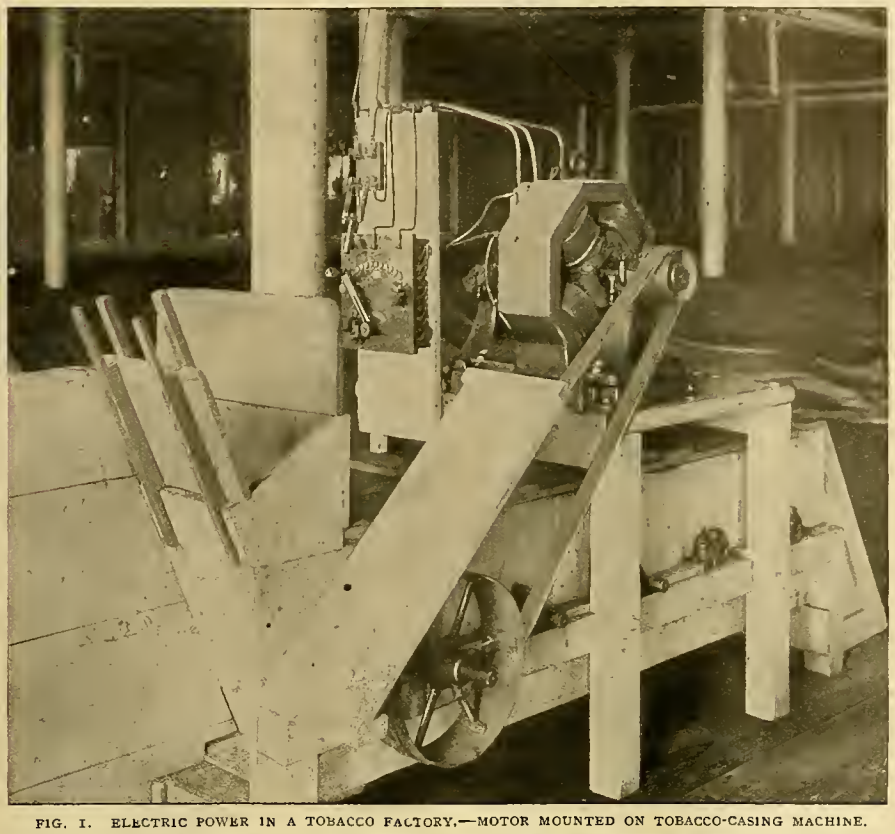


FIG. 1. ELECTRIC POWER IN A TOBACCO FACTORY.—MOTOR MOUNTED ON TOBACCO-CASING MACHINE.

Electric Power in a Tobacco Factory.

St. Louis has a large, recently constructed tobacco factory—that of the Liggett & Myers Tobacco company, now a branch of the American Tobacco company—in which the machinery is driven by electric motors. No less than 1,000 horse power in motors is installed in machines, ranging from four to 70 horse power in size. Direct-current apparatus is used, and the especial interest of the plant lies in its size and in its indication of the variety of machinery to which electric power is applied.

Electricity is used for lighting as well as power, and the generating plant consists of four direct-connected multipolar generators at 220 volts' pressure. Three of these generators are of 260 kilowatts' capacity each, running at 100 revolutions per minute; the fourth is of 100 kilowatts, running at 280 revolutions per minute. All four were manufactured by the Western Electric company of Chicago. The large generators are used during the day working hours and for night service when necessary. The small generator was especially installed for night and Sunday service, but is so arranged that it can be used in multiple with the larger machines if at any time the demands for power call for it.

The engines driving the large generators are plain Corliss, non-condensing, the exhaust therefrom being used in connection with the heating system. These engines were manufactured by the St. Louis Machinery company of St. Louis. The small generator is driven by a simple engine manufactured by the Russell Engine company of Massillon, O. Steam for the entire equipment of engines is supplied from a battery of six Abendroth & Root water-tube boilers located in a separate room adjacent to the dynamo room, the engines being specially located with reference to convenience and engineering requisites in the matter of length and arrangement of steam pipe, so as to secure a minimum loss.

The motors are of the four-pole, slow-speed Western Electric type and are distributed throughout the works in such manner as to operate with minimum loss consistent with utility and facility of control in special applications. The saving of floor space has been accomplished in numerous instances by mounting the motors directly upon or above the machine to be driven. This feature is illustrated in Fig. 1, wherein a five horse power motor is shown mounted upon a machine which is used in the treatment of the tobacco in its preparation for the presses where it is finally formed into plugs. The controller and switch are also mounted upon the machine, and it is, therefore, not necessary for

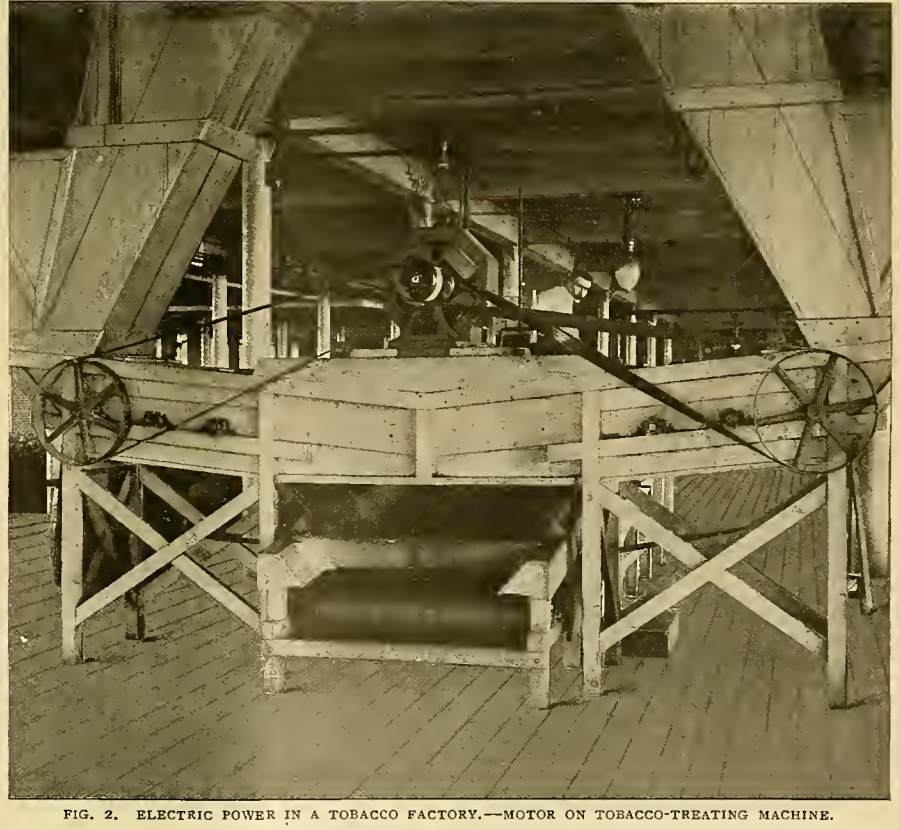


FIG. 2. ELECTRIC POWER IN A TOBACCO FACTORY.—MOTOR ON TOBACCO-TREATING MACHINE.

an attendant to leave the machine in case he wishes to stop or start it.

In Fig. 2 (p. 379) is illustrated another form of tobacco-treating machine with the motor—in this case of 10 horse power capacity—mounted above it and connected by separate belts to different parts of the

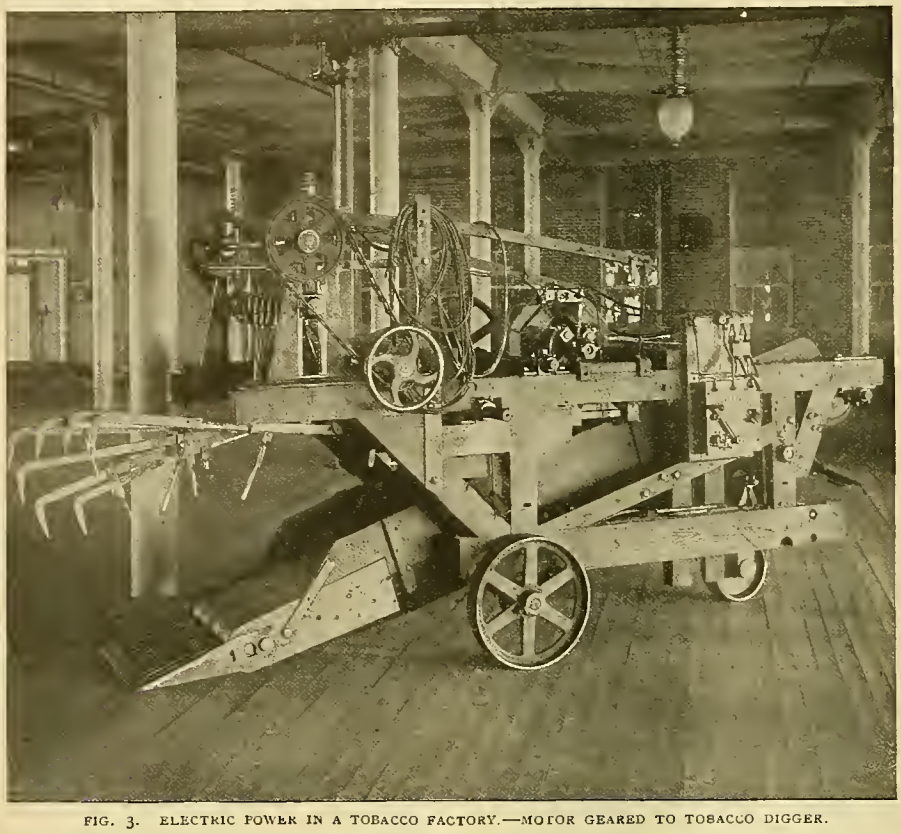


FIG. 3. ELECTRIC POWER IN A TOBACCO FACTORY.—MOTOR GEARED TO TOBACCO DIGGER.

operating mechanism. By this means the old-time overhead or floor countershafting is done away with, and each treating machine, with its motor, becomes an operating unit.

In the treatment of tobacco at a certain stage of its preparation it has been found desirable to make use of a machine called a digger, which can be moved around readily from place to place, and which is moved slowly along over the floor in the operation of "digging." In this machine the motor and controller, as shown in Fig. 3, are located directly upon the framework and connected by gearing to the different moving parts, electrical connection to the motor being secured through the medium of a flexible cable of sufficient length to permit the necessary range of movement in the machine. This is a very interesting application and well illustrates the extreme flexibility of a system of electrical transmission of power.

Lighting throughout the works is done by incandescent and arc lamps operating directly upon the 220-volt pressure, most of the arc lamps being of the enclosed type, connected two in series, the incandescent lamps being operated both singly and in series.

The Navy Department has decided to make its own experiments in developing space telegraphy and to abandon the proposition of Marconi for furnishing the navy with apparatus and other appliances. Rear-admiral Bradford, chief of the Equipment Bureau, it is said, will shortly establish two stations, one at Newport and the other on Coasters Island, across the bay from the Newport Apprentice School, where classes will be formed to begin the work of developing wireless telegraphy. This decision was taken because the terms presented by Marconi were regarded as excessive.

Pan-American Exposition.

With Niagara electrical power for supplying current to the various exhibits at the Pan-American Exposition in Buffalo in 1901, some especially interesting exhibits may be looked for. The illustrations here shown give an idea of the changes in architecture from previous expositions. Colors are to prevail instead of white in the decorations and the electrical illumination will thereby be different in effect from what has been before attempted.

The board of architects of the exposition is composed of eight members, three residents of New York, two of Boston and three of the city of Buffalo.

Mr. Walter Cook, of the firm of Babb, Cook & Willard of New York, designs the Stadium, the screen in front of the railway station and the entrance of the Midway, all of these forming the Plaza, shown in Fig. 1. Mr. Cook is president of the New York Chapter of Architects, and was the only American on the commission which met at Antwerp and San Francisco to decide the competition for plans for the University of California. Mr. Cook studied under Vaudremer. Mr. Edward P. Green, a member of the firm of Green & Wicks of Buffalo, is the designer of the Machinery and Transportation building, shown in Fig. 2, and also of the Electricity building.

The Machinery and Transportation building, 500 by 350 feet, faces on the Mall. This building is designed in a type of Spanish Renaissance, with initial inspiration in the Mission buildings found in Mexico and California, supplemented by later examinations of Renaissance work in Spain, modified to suit the conditions of the exposition, with its gay and festive surroundings.

Briefly stated, the Machinery and Transportation building forms a hollow square, with arcades on all sides. In the interior is a court 100 by 200 feet, adorned by a long pool of water, with an electric fountain surrounded with shrubs and flowers, artistically planted. This sheet of water, with its calm reflection and its atmosphere of quiet restfulness, forms one of the many little oases planned for the refreshment of the weary sightseer.

The roofs are of red tile, the walls of cement, and the whole structure is ornamental and covered with glowing colors.

The façades present an arcaded effect, corresponding in appearance to mission cloisters; the eaves, with great overhangs, add to the picturesque. Each façade is broken by an important architectural feature, and each corner flanked with low pavilions, the design giving large plain surfaces for color, while the eaves give deep shadows. The color scheme is made up in reds and yellows, light in tint. The loggias, balconies, pavilions and other places are to be ornamented with shrubs, vines and flowers, blending with the coloring of the building, giving fine opportunity for electrical effects. The openings are grilled with specimens of wrought-iron "rejas" or grill screens, such as are seen in examples of Spanish architecture of the sixteenth century.

The building has numerous entrances, the principal ones being in the center of the four façades. Once inside the structures, the size will be appreciated. All the towers, pavilions and other proper spaces are to be brilliantly illuminated and made gay with banners and flags.

The northern part of the exhibition ground is occupied by a square about 500 feet from east to west and 350 feet from north to south. Here the style adopted—a very free version of Spanish architecture—has suggested the name of the Plaza, which has been given it. The central portion of this square is occupied by a terrace only very slightly raised above the surface of the square, and surrounding a sunken garden, in the middle of which is a bandstand. The terrace, as well as the garden itself, will afford a large space for listeners who attend the concerts which it is proposed to give.

Outside, and at the north of the Plaza, is the railway and trolley station, from which it is supposed the greater number of visitors will enter the exhibition grounds. The railway station itself is masked by a colonnade, flanked at either end by two colossal arches, one for those entering the exposition, and the other for those leaving it. This colonnade, as shown in Fig. 1, bounds the Plaza on the north. It is surrounded by a trellis, which it is proposed to cover with vines of various sorts.

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FIG. 2. MACHINERY AND TRANSPORTATION BUILDING.

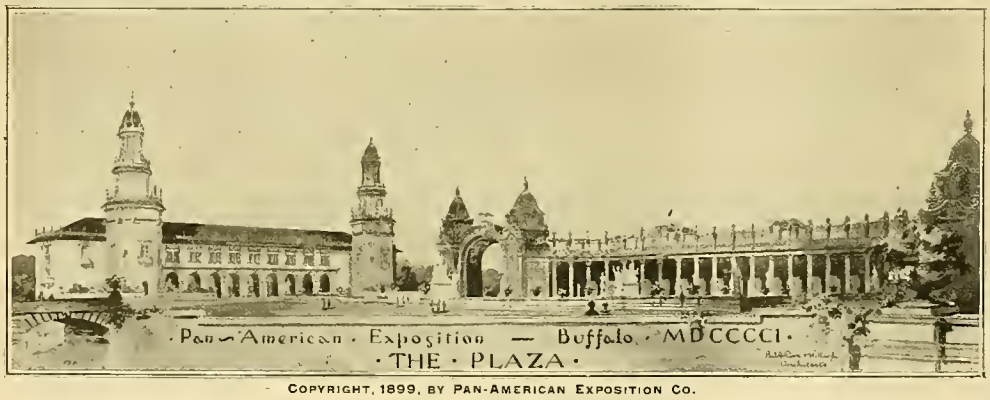

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FIG. 1. THE PLAZA.

The west side of the Plaza is bounded by a building which is to serve as a large restaurant. The public pass through the lower arches of this building, which are open, in order to reach that portion of the exposition which is to be called Vanity Fair, and which corresponds with the Midway Plaisance at Chicago. The restaurant building itself is two stories high and is about 350 feet long.

On the east side of the Plaza is a building closely resembling the restaurant, which serves principally as the entrance to the Stadium or athletic field, although portions are also used for exhibition purposes. This also has two stories, the upper story being a large open gallery, from which views of the Plaza on the one side and the Stadium on the other are afforded.

Finally, the south side of the Plaza is bounded by the electrical tower, the designing of which has been given to Mr. Howard.

The Stadium or athletic field has been in all its details a subject of careful study. It resembles, in a general way, that erected at Athens a few years ago, although this one can be, of course, only a temporary structure. It will contain easily 25,000 spectators, and is intended as a model of what it is hoped may be executed some day in permanent form. It has a quarter-mile running track and a sufficiently large space in the inside of this for any of the athletic games. Great attention has been paid to having a large number of aisles to reach the seats, and, in, addition to the principal entrance on the

west, there are provided seven large exits. These exits are made of sufficient breadth and height to admit, in case of need, the largest vehicles or electrical floats, as it is proposed to use the Stadium for certain pageants, exhibits of electric and other automobiles in operation, the judging of horses, live stock, agricultural machinery, road machinery, etc. No exhibitor has ever had such a splendid arena in which such exhibits can be displayed, and the athletic carnival, to which the Stadium is particularly devoted, is expected to be one of the most interesting features of the exhibition. The space under the seats is to be used for exhibition purposes, and is in itself the equivalent of a very large building.

The total length of the Stadium, including the building which forms the entrance, is about 870 feet, and the breadth about 500 feet.

A Wedding with Electrical Accessories.

The account of a unique wedding of quite unusual interest comes from Atlanta, Ga. The uniqueness of the affair was due to the arrangement of the electric-lighting effects. Mr. F. H. Lansdell, the groom, is a prominent electrical contractor in Atlanta, and the electrical features were due to his ingenuity.

Five hundred incandescent lights were used to carry out the scheme. A festoon of 200 lights extended from one side of the church to the other. It was supported by two large chandeliers over the chancel, and its apex was upheld by invisible wires. These lamps were covered with white and pink tissue-paper, the colors alternating, and entwined about them were tendrils of evergreen.

Directly over the spot reserved for the bridal couple hung a wedding bell six feet high, formed of cedar boughs, chrysanthemums and about 100 colored lights. A suspended arc light from the interior of the bell represented the clapper. To the right of the bell a letter N, the initial letter of the name of the bride (Miss Daisy Nimmo), formed of white incandescents, set in pink flowers, was supported on invisible wires. A letter L, similarly formed and suspended, was on the left. Before the ceremony only the festoon and the white lights on the bell were lighted.

In describing the wedding service the Atlanta Journal of recent date says: "As the bride with her brother entered the church by one aisle and the groom with his best man entered by the other the letters N and L flashed into view and sparkled with great splendor. A murmer of admiration arose from the auditorium at the superb effect. Under the bell in the radiance of the arc light the scene was exquisite. Dr. W. B. Stradley, the pastor, performed the ceremony. As he pronounced the words which made the couple man and wife the letter on either side of the bell faded from view, while a single letter L in pink incandescents appeared on the bell and burned with a soft brilliance while the bridal party left the church."

Northwestern Electrical Association.

Members of the electrical fraternity throughout the Northwest have been notified of the eighth annual convention of the Northwestern Electrical association, which will be held at the Hotel Pfister, Milwaukee, Wis., commencing at 11 a. m. on Wednesday, January 17th. An exceptionally good programme has been arranged, including papers by Professor Jackson of Wisconsin, Professor Shepardson of Minnesota, Professor Richter of Wisconsin, R. Fleming of Massachusetts, W. H. Schott of Illinois, H. W. Frund of Indiana, N. H. Dow of Michigan and G. Van Ness of New York, all on subjects of practical interest to central-station men. Besides the general business to be transacted, officers will be elected and important changes in the by-laws considered. Theater parties and other attractions are being arranged for Wednesday evening and the annual banquet will be held on Thursday night. A 1½ round-trip rate has been obtained on the railroads, and it is stated that reduced rates will be offered by the hotels. Mr. James Wolff, 320 Dearborn street, Chicago, chairman of the transportation committee, may be addressed in relation to railroad rates, reservations, etc. The meeting promises to be a large and interesting one.

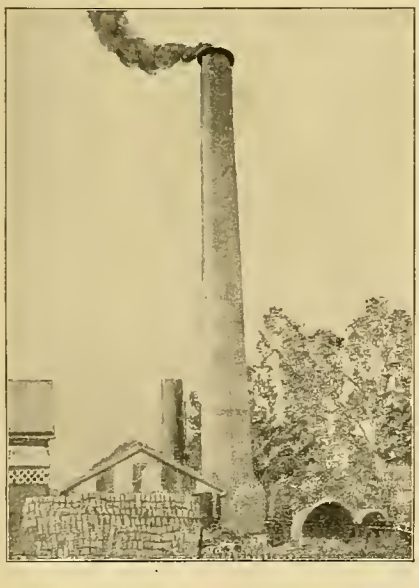

FIG. 2. ELECTRIC LIGHTING IN PRETORIA.—LARGEST BRICK STACK IN SOUTH AFRICA.

Electric Lighting in Pretoria.

Although Pretoria, viewed in the light of its present-day importance as capital of the South African Republic, is a comparatively small town, the lighting of the place seems to be entirely satisfactory to the residents. The Pretoria central station has not yet assumed large proportions, but the installation is larger than most people would surmise, and it meets the town's requirements. The service is, moreover, of excellent quality. It is interesting to note that the Pretoria central station is to-day generating and has for the last five years disposed of a larger output than the corresponding plant at Cape Town, which has a far larger population to cater to. Even taking it for granted that there are private installations in Cape Town, and that gas is there an important competitor, while Pretoria possesses neither, it is plainly evident that the smaller town is as well if not better off in the matter of electric light than the Cape metropolis.

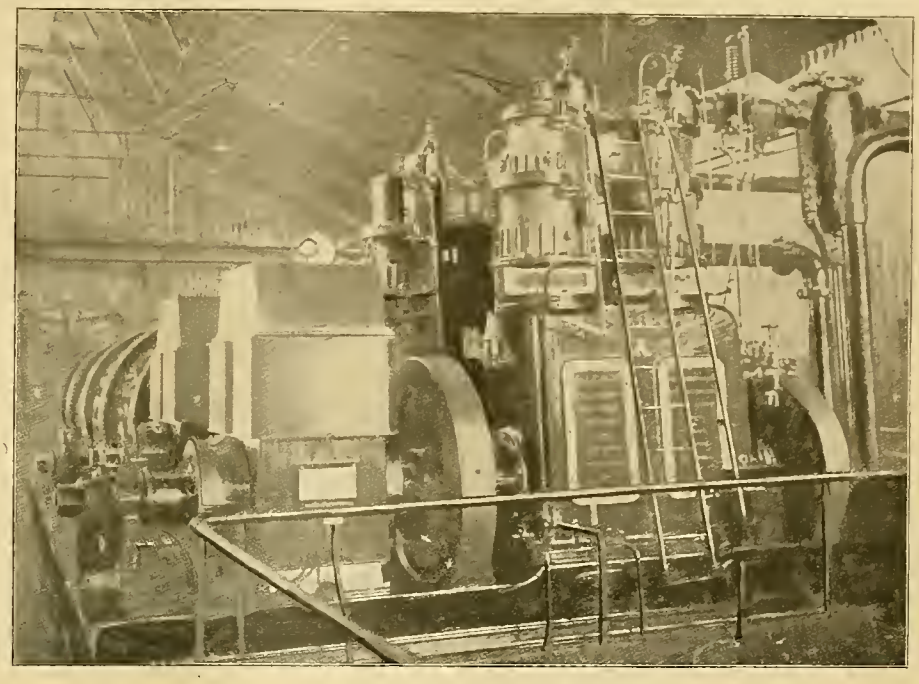

FIG. 1. ELECTRIC LIGHTING IN PRETORIA.—THE "NEW PLANT."

A Johannesburg contemporary gives the following data: In 1896 Cape Town generated 188,753 effective units (kilowatt-hours); in 1897, 312,300 units; in 1898, 362,711 units. In 1896 Pretoria generated over 300,000 units; in 1897, over 350,000 units; in 1898, over 450,000 units; and it is more rapidly increasing its output than Cape Town.

Electric light was introduced in Pretoria eight years ago, when small belt-driven dynamos were installed for the purpose. These machines, which formed the original plant, are still effective for use, and consist of five Crompton continuous-current, bipolar dynamos designed for 120 volts and 320 amperes and a speed of 770 revolutions a minute. Each machine is belted to a Davey Paxman horizontal compound engine, working at 140 pounds' steam pressure and capable of exerting 75 horse power at a speed of 120 revolutions a minute. The engines are supplied with steam from a battery of five Davey Paxman 30 horse power locomotive boilers, the gases from which escape by one main flue to a brick smokestack about 60 feet high. A Crompton switchboard, with a suitable arrangement of switches, voltmeters and ammeters, and a light overhead traveler, may be said to complete what is now termed the "old plant." As this equipment has been superseded by the new plant, it is not in use now, and is not likely to be put in operation again unless the latter is disabled through accident.

The "new plant," shown in Fig. 1, was installed about two years ago by Messrs. Hubert Davies and Spain, and the generating portion consists of two 126-kilowatt generators, designed for 260 volts' pressure. These are coupled direct to two Bumstead & Chandler compound-condensing engines, working under a steam pressure of 160 pounds, and running at 340 revolutions a minute. The cylinders are: Low pressure, 22 inches; high pressure, 14 inches, and stroke, nine inches. All the working parts of the engine, excepting the Chandler governor, which is operated off the crank shaft, are entirely enclosed. Each engine is provided with forced lubrication, an engine counter and a Giepel steam trap.

Two equalizers are used. One is wound for 120 amperes at 120 volts, and the other, made by Siemens & Halske, is of similar capacity. A separate switchboard serves the new plant. The main cables from the generators are laid underground throughout the town, and consequently no trouble is experienced from lightning shocks. Thomson-Houston lightning arresters are used where necessary, however. The cables now in use are steel-armored, in the place of lead-covered, which were at first tried, but did not prove entirely satisfactory, owing to their too rapid depreciation. The present cables, on the other hand, are giving satisfaction.

Although water is very plentiful and of excellent quality for steaming purposes, a complete condensing plant is worked in conjunction with the new engines. This is situated at one end of the engine room, about six feet below floor level, and consists of a horizontal 14-inch air pump, working at 55 revolutions a minute, and a five-inch centrifugal pump, running at 600 revolutions a minute, for circulating, and a return-water pump, at 850 revolutions a minute, driven by a 10 by 14-inch Marshall vertical engine. The condensers, of which there are two connected together, are situated outside the building. These, which were made in Germany, are of the vertical type, the tubes being enclosed in a cylindrical casing open at the top. The water passes in jets through small holes in the tops of the tubes, and runs down in thin films, the cooling being aided by forced draught obtained by means of a separately driven fan. The condenser has a much larger capacity than the present steam plant requires, and appears to be giving a high efficiency.

The new boiler plant, erected to generate steam for the Bumstead & Chandler and condenser engines, consists of four 100 horse power "Marshall's Heine" water-tube boilers, designed for 160 pounds' working pressure. It is provided with low-water alarms, in addition to the usual regulation mountings. The gases are led into the chimney through a flue 15 feet six inches by three feet wide. The chimney (Fig. 2) is probably the largest brick chimney in South Africa, being 151 feet six inches in height by 13 feet six inches outside diameter at the bottom and nine feet three inches at the top. The flue is seven feet in diameter.

A test of Onspoed coal made with these boilers gave the following very satisfactory result: Twenty thousand pounds of water was evaporated at and from 212 degrees Fahrenheit by 2,500 pounds of coal, or eight pounds of water for each pound of coal. The consumption of the same African coal in these boilers works out at from 11 to 12 pounds per electrical unit generated.

During 1898 the output for the year was 476,000 units, being an increase of 90,000 units over the previous year. The whole output is utilized for lighting only, no current being generated for power purposes. At the end of the year the company had an equivalent of 14,000 eight candle power lamps connected, in addition to 77 arcs of 500 candle power each. Current was supplied to the mains for 4,660 hours, and to the street lamps for 3,000 hours. How rapidly the demand is increasing may be gauged from the fact that 28,250 units were generated in June, 1805; 35,700 in June, 1897; 43,440 in June, 1898, and 48,250 in June, 1899.

The price to consumers ranges between 30 and 42 cents a unit, and even at this very respectable price, the demand is ever increasing. On this account the new generating plant, which cost $100,000, is to be increased by another direct-coupled set and two more Heine boilers.

Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:
510 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 148 Times Building, New York.

Trade Supplied by Western News Co.

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In extending the greeting of a Happy New Year the Western Electrician feels reasonably sure that this conventional expression means more to its subscribers and friends at the close of 1899 than for several years past. The year has been a good one to the favored inhabitants of these United States; it has made good the bright prospect of last New Years; it has been a year of good times and good prices. May there be many such to all to whom these presents may come!

The question whether electricity generated in a foreign country and imported into the United States by the use of suitable conductors should be subjected to a customs duty is again before the Treasury Department. Complaint is made of the foreign-made untaxed electricity at Niagara Falls, and a Washington correspondent of the Western Electrician details the situation in a brief article on another page. The decision seems to rest on the answer to the question, Is commercial electricity a "manufactured article" in the meaning of that term as employed in the United States statutes relating to the tariff? If the answer is an affirmative one, it is thought that the imported current must be assessed at a rate of 20 per cent. ad valorem; otherwise, it will be admitted duty-free.

State courts have held that manufactured electricity is a thing in which a proprietary interest may be had and which may be stolen. In Illinois there is a statute expressly prohibiting the unauthorized appropriation of electricity generated for industrial use. By analogy, it would seem that electricity may be such a manufactured article as would come under the classification of the tariff law. However, the decisions of the courts in cases where the theft of electricity has been charged have not been uniform, and, so far as is known, the United States courts have not passed upon the point.

From a common-sense point of view, aside from the legal status of electricity as an article of international commerce, it would seem that the United States is in no need of tariff protection against the foreign article, which must, in the present state of the art, necessarily come from Canada or Mexico. We should be able to produce at home electricity in quantity sufficient to supply all our needs, and in price cheap enough to defy foreign competition; in fact, we should be exporters rather than importers, so that the issue might be settled on a basis of reciprocity. Although broached in all seriousness, the question has a tinge of absurdity. For instance, would there be an added duty on storage-battery cells if they were imported into this country charged rather than uncharged, and if so, how much? And if electricity is sent into the country over a wire without paying duty, is the American consumer a smuggler?

It is not often, in these days, that an electric-lighting company's customers increase more rapidly than it can take care of them. But that is the case with the Metropolitan Electric Supply company of London. The troubles of this company were set forth in these columns six weeks ago, but it is still in hot water. Consumers' circuits are still being switched off at the hours of maximum demand, and complaints are numerous. In reply to a number of letters in the Times, the secretary of the company explains that the delay in the delivery of the ironwork for the new station at Willesden (equipped with Westinghouse engines and dynamos) was the prime cause of the defective supply. Until a short time ago, assistance was afforded from the London Electric Supply corporation, which supplied the Metropolitan company with a certain amount of high-pressure electrical energy "in bulk," but this corporation is now unable to continue this supply. One of the three 2,500 horse power sets is now in service, but the others are not yet in complete working order, or were not two weeks ago. The company is also troubled with difficulties in obtaining Welsh coal for its London stations. In addition to this, it is said that the Manchester Square station was shut down for repairs rendered necessary by the constant overloading. At a recent meeting of the Marylebone vestry it was decided to inform the company that, on failure recurring, the vestry would proceed against it under the penal clauses of the electric-lighting order. The Paddington vestry threatened a similar step. A recommendation of the electric, gas and water committee was adopted to the effect that a copy of the surveyor's report relating to the intermittent lighting of Westbourne Terrace be forwarded to the Metropolitan Electric Supply company, with an intimation that, should the arc lamps stationed there still continue to go out, the committee would have no alternative but to recommend the vestry to put in force the penal clauses of the order, with a rider authorizing the committee, at its discretion, to take proceedings against the company.

The case of this prominent company has attracted wide attention in London, where a failure of an accustomed source of artificial light supply at this season occasions even more inconvenience than it would here. Several technical journals point out that central-station companies are too anxious to connect new consumers before the machinery for supplying them all the year around has been erected. But the company lays great stress on the scarcity of Welsh coal and insists that with all the drawbacks it would have been able to meet the demand if it could have obtained coal of proper steaming quality. Of course, the scarcity is ascribed to the government's demand for the use of transports carrying troops to South Africa. Truly ours is a complex civilization; the Boers declare war in the Transvaal, and London, 6,000 miles away, suffers in its electric-light supply.

Although it is unlikely to become a law, and apparently ought not to be passed, a bill recently introduced in Congress by Mr. Reeves, the chairman of the House committee on patents, is of great interest. This measure is intended to regulate the relations of inventors, manufacturers and the Patent Office, and seems intended to foster the interests of the inventors and the public at the expense of the manufacturers.

Under the terms of this bill any person or persons or corporation which shall manufacture anything hereafter patented shall pay into the hands of the commissioner of patents, for each of the things so manufactured, for the use and benefit of the patentee, as a royalty for the privilege of manufacturing and selling the patented article, a sum of money not less than one per cent. nor more than 10 per cent. of the estimated cost of manufacturing such patented article or thing, the royalty to be determined by the commissioner of patents. Upon receipt of this sum the commissioner will issue a stamp or certificate showing that the royalty has been paid, and this stamp or certificate shall be attached to such manufactured articles where practicable, and in all cases shall be delivered by the manufacturer to the purchaser, whether attached or not. No patented article will be allowed to leave the hands of the manufacturer without the stamp or certificate.

Upon making application for letters-patent, or at any time prior to the issuing of any letters-patent, the inventor or applicant shall file with the commissioner of patents his sworn statement of his estimate of the cost of manufacturing such patented article, under favorable circumstances and with proper machinery and facilities. From this estimate the commissioner will fix the amount of royalty to be paid by the manufacturer upon each article manufactured under the patent. The provision is made that the owner of the patent, or any manufacturer thereof, may have the rate of royalty readjusted from time to time by the commissioner of patents, upon proper notice having been given to all interested persons. Such readjustment shall not occur oftener than once in two years.

Each person or corporation manufacturing any article upon which a patent has been issued under the act in question shall make a semi-annual statement, under oath, of the number of articles manufactured and file it with the commissioner of patents. Failure to make such return will be held to be sufficient cause for the issuing of a perpetual injunction by the court, restraining any such person or corporation from manufacturing or selling any such article. False return made as to the amount or number of articles manufactured will be held to be perjury.

Another provision of the measure is that in the granting of all patents hereafter the United States reserves the right to condemn such patent by proceedings instituted in the proper court, which proceedings shall be for the purpose of determining the fair and reasonable cash value of such patent at the time of such trial in such condemnation proceedings.

While the object of this bill seems to be the benevolent one of encouraging invention and at the same time protecting the public from extortionate monopoly, its practical operation would clothe the commissioner of patents with unusual and despotic powers and would probably make it much more difficult to sell patent rights than at present. And what is to prevent the manufacturer from purchasing a valuable patent outright and then, in the furtherance of his own interest, shelving it? The bill provides for a royalty on articles manufactured, but what if only a very few articles, or none at all, are made? Perhaps the condemnation feature of the act would be here invoked, but it would be found that in attempting to determine the equities of "pushing" an invention the government would have entered upon a most perplexing course, with danger of setting up as great an injustice as it was sought to remedy.

FOREIGN ELECTRICAL NOTES.

The first congress of Russian electricians is being held at St. Petersburg and will last until the 8th of January. It is under the auspices of the minister of the interior and the Imperial Technical society. This congress is designed to establish closer relations between the electrical engineers of Russia and to bring out and discuss engineering and scientific questions, inventions and their application to the industry, etc., as well as the discussion of technical instruction in Russia and the means to be taken for its development. An exhibition is to be held in the rooms of the Technical society, including models and drawings of the different inventions which have been submitted. This congress is one of the indications of the increasing importance now being taken by Russia in industrial and engineering matters.

During the last year the federal administration of Switzerland has examined and authorized 103 projects for electric plants of different kinds; the previous year there were but 63. Of these installations 70 are entirely new and 33 are changes or extensions of existing systems. They may be classified as follows: Thirty-three lighting stations, of which 23 use continuous current and 10 alternating; 23 stations for power transmission, of which 15 use continuous current, one two-phase current and seven three-phase; 14 other stations have both lighting and power transmission, one-half the number using continuous current. It will be noted that the continuous current takes the precedence, it being 64 per cent. of the total. Classed according to their capacity, there are 48 plants of one to 100 kilowatts, a total of 954 kilowatts; 19 from 100 to 1,000 kilowatts, giving in all 5,435 kilowatts; also three large plants of more than 1,000 kilowatts, giving 10,465 kilowatts. The total capacity of all the stations is thus about 17,000 kilowatts.

An important hydraulic plant is now in construction on the banks of the river Vezere, France, which will furnish light and power for the city of Limoges and the surrounding district. The hydraulic work is nearly finished and the remainder will soon be taken up. The power will be obtained by a canal taking the water of the river to the station, where the head will be 43 meters; the water descends by two iron tubes, each one meter in diameter. In the station will be installed four turbines of 400 horse power, each driving an alternator, and space is provided for four other units, which are to be subsequently placed. A maximum of 4,000 horse power is expected. The lighting company of Limoges has contracted for 1,000 horse power and the remainder will be used by the different towns traversed by the lines. A pressure of 20,000 volts is to be used on the main lines, as distances such as 75 kilometers, must be covered. Near Limoges will be placed a sub-station, from which the current, at reduced tension, will enter the town by conduit and overhead systems. In this way the district will be one of the best equipped for light and power in France.

A series of tests of arc-lamp carbons has lately been made by a German company, the Stralsonder Arc Lamp Works, in order to determine which of the different makes give the best results. The first series of experiments was made with a standard lamp of the company's make, provided with carbons of the well-known makes, having diameters of 13 to 17 millimeters; the current used was about six amperes. The length of the arc was at first 3.4 millimeters, but at the end of two minutes it fell to 1.6, then to 1.5, and, finally, to 0.8 millimeter. It increased and diminished constantly, in spite of the constant potential of 38 volts at the terminals. It was observed that carbons of different makes give lengths of arc which are extremely variable with the same current. The experiments made with a view of establishing the lengths of arc corresponding to different currents have also given very different results, according to the makes of carbons tried. There was besides a great variation of light intensity as measured by the photometer. The conclusion of the tests was that too great care cannot be observed in choosing the carbons and that the best makes only should be used if a real economy is desired.

An extensive system of electric railways is now being installed in London by the United Tramways company. It will cover a total of 39 miles, or 75 miles of single track. Of this 27 miles is now under construction. There is a possibility that the city government will oppose the use of the overhead-trolley wire in certain parts of the road, principally on account of induction disturbances, but the company proposes to overcome the difficulty by using a double trolley in the part of the road where underground conduit is not used. The large generating station at Chiswick is to have eight horizontal water-tube boilers, and above these will be placed the coal-bins. A bucket conveyor, with a capacity of 4 tons a day, delivers the coal to the bins from the outside. In the engine room will be placed four vertical engines of 750 horse power each, at 90 revolutions. Three of these will be direct-connected to continuous-current generators and the fourth to a three-phase alternator of 500 kilowatts, working at 5,000 volts and a frequency of 25. The station also contains two smaller generators of 75 kilowatts, each at 500 volts, driven by tandem-compound engines; these are to be used for lighting. The alternating current will be distributed at 5,000 volts to a sub-station by lead-covered cables, with paper insulation. At the sub-station seven transformers will reduce the voltage to 350. The four rotary converters will have a capacity of 200 kilowatts and are of the six-pole type, at 500 revolutions. They give a voltage of 500 for the trolley wire. The installation of the road is under the direction of Mr. Clifton Robinson, a prominent English engineer.

A French inventor has lately patented a process by which cast-iron may be coated with copper. To accomplish this, the casting is dipped in an acid bath to remove the oxide; it is then filed and chiseled as usual, where necessary, and then covered with a thin coating of copper in an alkaline electrolytic bath. The irregularities of the surface, such as cracks and holes, are then filled up with fusible alloy; the layer of copper gives a much better adherence for the alloy. After scraping smooth, another thin deposit of copper is put on in an alkaline bath. The object is then taken to an acid bath of copper sulphate and a good coating of copper is given. In order to save time in procuring the desired thickness of deposit, the inventor uses a special electroplating apparatus in which the bath is in constant movement, and by this means a greater current density may be used; in fact, up to 10 amperes per square decimeter of cathode surface. To obtain this, the liquid passes by an overflow pipe at the top of the tank and is forced by a pump to a reservoir placed above; it is again brought down to the tank by a tube ending in a spiral which surrounds the object and is pierced with small holes by which the liquid escapes in thread-like streams, which strike the object and prevent the accumulation of hydrogen.

The electrolytic cartridges lately invented by M. D. Tommasi promise to come into use for explosions in mining work, etc. These cartridges are of two kinds. The first consists of a cylinder of thick glass filled with a concentrated solution of carbonate of potassium; the cylinder is sealed by fusing one end. A platinum wire passes through the glass into the solution, and when the current passes the solution is decomposed by electrolysis, causing an accumulation of carbonic-acid gas and hydrogen under a high pressure, which increases until the cylinder explodes with great force. The second type of cartridge contains a solution of chloride of ammonium, which, ordinarily, is quite inoffensive and may be transported without danger. Upon the passage of the current, it is decomposed into chlorine, ammonia and hydrogen, and afterward the chlorine acts upon the ammonia, decomposing it to hydrochloric acid and chloride of nitrogen, which latter is a very explosive body, and thus when the tension becomes sufficient to rupture the glass, the shock explodes the chloride of nitrogen, which detonates with great power. The advantage of these cartridges will be seen from the fact that they become explosive only upon the passage of current and there is comparatively little danger from their use.

A new system of electric traction for canal boats is now being tested upon the canals of Aire and Deule, in France, over a length of 26 kilometers. To draw the boats a kind of tricycle is used which takes current from a trolley wire. These tricycles carry their motors between the front and rear axle, operating the rear wheels by intermediate gearing. Quite in the rear of the vehicle is a kind of cabin for the motorman, containing the controller, instruments, brakes, etc. The tricycle weighs two tons and is capable of giving a tractive effort of from 500 to 600 kilogrammes. In practice from 80 to 170 kilogrammes is required, according to the condition of the track. It is expected that, owing to the light weight of these tricycles, the road will not suffer more than it would from horses' hoofs. The electrical conductors following the canal are fed by two hydraulic plants. On the present system two overhead wires are used and a double trolley or, rather, rolling carriage. In Germany two similar systems are being tested upon the Dortmund-Ems Canal; in one case electric locomotives run on a track parallel to the canal and take current from an overhead wire. In the second case the tractor runs along two wire cables stretched upon a series of posts, forming thus a kind of track, and the current is taken from a conduit by a double contact. These two systems have given satisfaction up to the present, and it is expected that their practical use will follow.

Tests of the new submarine torpedo boat Narval have been made at the naval station of Cherbourg. The boat was designed by the naval engineer, Laubeuf, and its plans were submitted to the government at the time of the competitive trials of 1886, when the design received a gold medal from the minister of marine. The hull of the boat is constructed entirely of steel; it has a displacement of 106 tons, being 34 meters long and 3.7 wide. Its draught is 1.60 meters of water when at the surface. The Narval differs in many respects from its predecessors and is designed to work under three different conditions. In the first case the top of the hull floats at the water level; in the second the boat is submerged all but the observation dome and smokestack; in the third all the openings are closed, the chimney drawn in and the boat navigates entirely under water. In the first two cases the motive power is supplied by a petroleum motor, invented by M. Forest, and which received a prize of 3,000 francs for the best design in the tests of 1896. In the case of entire submersion, the propellors are operated by an electric motor, fed by a battery of accumulators. The oil motors are equipped for a run of 466 kilometers at 12 knots an hour, or 1,155 kilometers at eight knots; when submerged, the accumulators provide for a distance of 46 kilometers at eight knots or 129 at five knots an hour. This type of boat is designed to be submerged only in presence of the enemy; usually it navigates on the surface. The armament includes four tubes for launching torpedoes. The personnel is made up of two officers and nine men.

The construction of the electric road to the summit of Mount Blanc is to be one of the most important pieces of engineering work carried out in Europe for some time past. The work is to be under the direction of French engineers and the project has been presented to the General Council of Haute-Savoie by M. Fabre. It has been approved and the work will be commenced shortly. On this line the rack-and-pinion system will be used, on account of the steep grades. The starting point will be in the commune of Houches, near the line now constructing from Chamounix to Fayet; the entrance to the gallery will be at a point of 1,100 meters' altitude. The line will follow the mountain along the Grand Glacier. A part of the route will be through a subterranean gallery of five kilometers in length, going up to an altitude of 3,840 meters. A series of terraces is to be established along the route at different points, from which magnificent views will be obtained of the mountains and glaciers. At the summit of the Aiguille du Gouter, a high peak, will be installed a hotel station, comfortably arranged for tourists. From this point the road continues up the mountain to another station at the Roches des Bosses, at an altitude of 4,360 meters. The terminal station of the line, which is 300 meters below the summit of Mount Blanc, is at an altitude of 4,580 meters. From this point the summit will be reached over an easy grade of hardened snow by a system of cable sledges conducting the passengers to the Hotel Terminus, at the highest point of the mountain, an altitude of 4,810 meters. The total length of the line from starting point to summit is 10 kilometers. It is estimated that by next July the work will be advanced as far as the Dome du Gouter, 3,500 meters' altitude, from which a fine panorama of the Alps will be obtained.

Electric Power in Northwestern Railway Shops.

An interesting example of power transmission is found in the new power house and electric-transmission system now being installed by the Chicago and Northwestern Railway company at its West Fortieth street shops in Chicago. These shops cover a strip of ground nearly three-quarters of a mile in length and have hitherto been provided with a number of individual steam plants. There is now being erected a large power station at the center of the shops, which is to provide light, heat and power for the entire system. The company is installing two 250 horse power Ball vertical cross-compound engines, each engine being direct-connected to two 75-kilowatt General Electric direct-connected dynamos. There is also to be added a small unit, consisting of one 60 horse power Ball engine, direct-connected to two 20-kilowatt General Electric dynamos. The motors throughout the plant will be of the General Electric company's manufacture and will aggregate several hundred horse power. The wiring throughout will be on the Edison three-wire system, providing 110 volts for the lights and 220 volts for the motors. The entire electrical outfit, including dynamos, motors and wiring, is being furnished by the construction department of the Chicago Edison company. It is expected that the plant will be in operation early in the spring.

American Electric Vehicle Company to Remove to New York.

After doing business for nearly four years in Chicago—being, indeed, one of the first, if not actually the very first concern, to engage exclusively in the automobile business, before the word "automobile" was invented, in fact—the American Electric Vehicle company announces its removal to New York on January 1st. The offices and factory of the company at 56 and 58 West Van Buren street will be vacated and the company will establish itself in a large plant in New Jersey, near New York, the factory to have a capacity of five vehicles a day, it is said. Mr. C. E. Corrigan, the manager of the company from the first, thinks that New York offers a better field for the automobile business, owing to the greater number of men of wealth and leisure in that city. He regards the outlook of the industry as most promising. Mr. Corrigan has been indefatigable in extending the electric-vehicle business and brought much energy and enterprise to the infant industry. He carries with him to the East the good wishes of many friends.

Patent Court Proposed.

An effort is to be made during the present session of Congress to secure the establishment at the seat of government of a high court of patents, trademarks and copyrights. To this end Senator Hansbrough has introduced a bill providing for the creation of such a court, to consist of one chief justice and six associate justices, and which shall be a court of record, with appellate jurisdiction, to review by appeal or writ of error final decisions in the United States District Courts and the existing Circuit Courts in all cases arising under the patent and copyright laws, and in all cases involving the ownership, violation and construction of trademarks and the question of unfair competition in trade.

DEVELOPMENT OF THE TELEPHONE FIELD.

Strowger Interests Active in New England.

In Chicago the Illinois Telephone and Telegraph company has a franchise enabling it to compete with the Chicago Telephone (Bell) company. It has a suite of offices connected with those of the Strowger Automatic Telephone Exchange (company), and its representatives have stated that the Strowger automatic system is to be used. However, the company is reticent about its plans, and beyond the fact that subscribers have been solicited and work begun on a tunnel, little is known about it. It is therefore of interest to observe that the Strowger people are actively at work soliciting franchises in New England and that some reference is made to the Chicago enterprise. For instance, John W. Watson, manager of the Strowger exchange at Auburn, N. Y., recently stated at a public hearing by the Board of Aldermen of Fall River, Mass., according to a local paper, that the new company in Chicago would begin with 19,000 subscribers and would have five exchanges. This is especially interesting, as the statement had been made that by the use of the automatic system in Chicago as many as 30,000 subscribers' telephones could be connected at one exchange.

The public hearing referred to was in relation to the application of the Fall River Automatic Telephone company for a franchise in that city in opposition to the Bell company. Mr. Richard P. Borden, as counsel, made at that time a statement of the case of the Strowger people which is of general interest to telephone men. As reported in the Fall River Globe, Mr. Borden's statement is, in part, as follows:

"The Strowger system made its first appearance at the World's Fair. It was imperfect as exhibited then, but there have been many alterations and patents since then, and a company which bought the patent has secured many valuable rights since then. The scheme has been to divide the country into districts. Franchises for Massachusetts and Rhode Island have been granted by the Eastern Automatic Telephone company. The men who received the franchise for this district have resolved to exploit their scheme here.

"The first place that the system has been put in is in New Bedford, the home of the Bell Telephone company. These men came to our office over a year ago, but before any attempt was to be made to establish the business here it was believed that it was best to be successful in the New Bedford undertaking. Interest in the matter ceased, until about six weeks ago, when a franchise was granted in New Bedford. When ground was broken in that city 20 of Fall River's business men, who have made a success in their own lines, were invited to take stock in the company, and we then formed what was known as the Fall River Automatic Telephone company.

"We make certain claims for our company. First is quick communication. There have been certain objections raised to the service in this city. For myself I have none to make. There is a lady with a pleasant voice at the other end of my line and she is very prompt, and I shall miss her very much when this Strowger system is put in, for we do away entirely with the central-office girls. The Bell company has had a monopoly here, and the people have suffered. The rates are far in excess of actual cost. What has already been the result of the coming of our company? On the exact day when our petition was filed, the Bell company reduced rates. Will those rates stay at the reduced prices or will they disappear? The reduction will disappear if you deny us our prayer.

"Our system has its advantages. You connect immediately with the person with whom you desire to talk. There is no central. You ring your bell and by so doing call your party. If the line is busy your bell will not ring. It takes about four seconds to make the connection, and there you have quickness in operation. Secondly, there is absolute secrecy of communication. Under the party-line system we are oftentimes suspicious that our kind neighbors are listening to our conversation with a friend, and this makes us feel a little bit uncomfortable. The nature of personal conversation and the requirements of business make secrecy of communication a very important element. In our company every subscriber has a private wire."

In reply to a question from Alderman Westall, Mr. Borden said that he would place in the franchise grant a provision for the purchase of the company after eight years.

John W. Watson, manager of the Strowger automatic exchange at Auburn, N. Y., and in charge of the district of Pennsylvania and Delaware, was called upon for information. To questions by Mr. Borden he said: "In Auburn, N. Y., there are from 350 to 400 subscribers. There are seven exchanges in New York state. I do not know of a subscriber that we have ever lost except by removal from the city. Last February the Bell rates were from $48 to $72 and we established a rental of $30 for offices and $24 for residences. Now the Bell rates are the same as ours. Every telephone has a circuit. The transmitters are long-distance. There is no difficulty with the switchboard. We guarantee its efficiency. We have frequently measured up the power of our own instruments and those of the Bell company. We have gone beyond the Bell telephones in such comparisons. In no city where a franchise has been granted has the system been taken out after once being established. When the patent was first on exhibition in the Chicago exposition there were five wires in each switchboard and it was an expensive, delicate mechanism. There were three buttons and if you wanted to ring 999 you pressed each button nine times. We have simplified all this, and are now preparing to build in Chicago. We go 31 feet under the surface of the street, and we will begin with 19,000 subscribers. The present capacity of the system is not limited. We will have five exchanges in Chicago."

Answering questions by Mr. Swift, the Bell lawyer, Mr. Watson said, as reported in the Globe: "We run our wires on the outside pretty much the same as the Bell company. We make this distinction, however. We run our wires in cables, while the Bell runs its wires in strings. We have passed a pole with 26 cross-arms on it belonging to the Bell by running the same number of wires in a three-inch cable. Our inside mechanism is much simpler than the Bell. We have two wires for each instrument. These are independent in each telephone. I have been connected with the system for seven years and in Auburn for about three years. Auburn is our largest exchange in New York. Our system has been adopted by the state of New York for hospital service and there are 100 of our telephones in the White House in Washington operated from the White House by 100 boys to the various departments."

Mr. Watson said that the largest exchange was in Augusta, Ga., where there were 800 telephones.

A committee of seven aldermen was appointed to investigate Strowger exchanges in other cities, and last week this body made a tour through New York state, examining the workings of the automatic exchanges in Auburn and other villages and cities in that state. The expedition was quite a formidable one, consisting of seven aldermen, the city messenger, three directors of the Fall River Automatic company, two directors of the Eastern Automatic company, an electrical expert and two lawyers representing the Automatic and Bell people respectively. The telephone directors in the party were W. B. M. Chace, John B. Huard and David Beattie of the Fall River company, and W. K. Dunbar and V. A. Sears of the Eastern company. Charles Sylvester was the expert.

Telephone Taxation in Ohio.

By a decision of the Ohio Supreme Court on December 19th a new method of tax valuation, far-reaching in its effects, will be established in Ohio. The decision directly affects the telephones of the Bell company, which are held to be taxable at their rental value, estimated at $233 each, instead of their actual cost, said to be $3.40 each. The suit was brought by the attorney-general, through a friendly arrangement between the auditor of state and W. H. Halliday, auditor of Franklin County. Mr. Halliday refused to list the telephones of the Bell company at their rental value, and suit by mandamus was brought to compel him to do so. The court gives a judgment for the relator.

In his letter to the state auditor directing the commencement of the suit, the attorney-general, estimating the number of Bell telephones in use in the state at 25,000, said:

"In ascertaining the market value of almost all other taxable property in the state we have assumed to fix the values at the earning capacity of the property on a six per cent. basis. If each of these instruments earns $14 over and above repairs to the Bell Telephone company, it represents a value of $233 to each instrument. On 25,000 instruments it represents an earning in the state of Ohio that is being protected by our laws and receiving all the benefit of police regulation of $5,833,000. Under the principle laid down in the Nichols law (which does not specifically refer to the Bell Telephone company), we take the entire value of their plant at $97,000,000, which is its market value, and take Ohio's proportion of it as a part of the unit. To put the Bell Telephone company on the same basis as the Western Union Telegraph company, or the express companies, and counting the average rate in the state as we do on those companies at 25 mills, the Bell Telephone company would owe to the state of Ohio taxes to the amount of about $80,000 annually. Or, taking one-third of the value off the original earning amount of $233 per instrument, would leave them about $160 per instrument as the taxable value.

"The Central Union Telephone company and other telephone companies refuse to pay the tax upon this property because they do not and cannot own these instruments. We have taxed all other corporations this year, in addition to the regular tax upon their property, $466,000 under the excise law. In simple justice to the other corporations that have had to bear their fair share of the burdens, I think it is your duty to at once send out notices to the county auditors of the state requiring them to place upon their respective duplicates in their taxing districts all of the property of the Bell Telephone company within our district at a reasonable valuation. If they have not already done so, they should be placed on the tax duplicate as delinquent for the five years last past."

Mr. Glidden and His Work.

In the course of a brief sketch of the career of Charles J. Glidden, the energetic head of the Erie (Bell) telephone system, a writer in Leslie's Weekly says: "Mr. Glidden is about 40 years of age, of medium height, weighs about 200 pounds, and carries with him the evidence of good-fellowship. It is believed that Mr. Glidden has the distinction of securing the first telephone subscriber to any exchange system in the world. This was in Lowell, in the year 1877. He also constructed, the following year, the first long-distance line between Lowell and Boston. Like every man with large responsibilities, Mr. Glidden works exceedingly hard. He takes a good, long rest, however, each summer, at his home on the Isles of Shoals, off Portsmouth, N. H. Here he enjoys himself, each year making a new record as an expert fisherman. This seems hardly in keeping with one who, when in the quiet of his own home, is a most accomplished musician and who has done as good work in amateur photography as can be found. It is interesting to note just here that early in the history of the Erie Telephone company even its best friends had but comparatively little faith in it. It was when the Erie was selling for 25 and 30 that Mr. Glidden predicted the greatest things for his company. To-day the stock is above par, and has made fortunes for a large number of people. Mr. Glidden has lived to see the Erie Telephone company operate more telephones and have a greater mileage than any other like organization in the world. There are now in operation 130,000 miles of wire, with 86,674 subscribers. The rate of increase of subscribers is now over 100 a day. The company operates long-distance lines from Boston to Galveston, Texas, of 2,200 miles; from Boston to Fargo, N. D., 1,800 miles, and from Boston to Omaha, 1,600 miles. What Mr. Glidden hopes to do with the use of a relay is to establish, among other things, a direct telephone line from New York to San Francisco."

Mrs. Craig's Exchange in Asheville.

It is stated that excellent service is given by the Independent telephone exchange in Asheville, N. C., which is controlled by Mrs. Charity Rusk Craig, the daughter of "Uncle Jerry" Rusk, the late secretary of agriculture. Mrs. Craig went to Asheville about three years ago with her husband, who was in ill-health. Mr. Craig died after they had been living there a couple of years and shortly afterward Mrs. Craig returned to her home in Wisconsin. Soon after her return friends who were interested in an Independent telephone company consulted her in regard to the practicability of establishing a plant in Asheville. Her residence there had given her so clear an insight into the possibilities for the success of such a project that she not only urged the establishment of the plant, but bought the controlling interest in the stock company that was formed.

Then she changed her plans and went back to Asheville, so that she could direct the affairs of the company. Up to that time she had had no practical experience in telephone affairs. She has had to acquire the necessary knowledge, and it has been gained according to the Froebelian principle of "learning through doing." She spends a part of every day at the office, keeps the books, pays the bills and signs all checks and receipts. Her practical knowledge has been gained partly through visits to plants in other sections of the country and partly through the close attention she has given to the development, step by step, of the Asheville plant.

The construction of this exchange was begun about one year ago, and in last March the lines were put into active use. About 650 telephones are operated by the company in or near Asheville.

There is no longer the slightest doubt about the success of the undertaking, and neither is there any doubt, judging from Mrs. Craig's experiences, that a woman can manage such a concern successfully.

Southwestern Independents Planning Toll Lines.

At a recent meeting of the managers of the Independent telephone systems of Southwest Missouri and Southeastern Kansas, held at Galena, Mo., preliminary measures for the establishment of a long-distance system, extending from Joplin to Kansas City and to Springfield, were taken. The toll charge is to be a uniform rate of 25 cents between all towns along the system. At the meeting Joplin, Galena, Carthage, Neosho, Pierce City and Girard were represented. G. W. Crawford of Girard was made temporary chairman, and George R. Armstrong of Pierce City secretary. The matter of improving the service of Independent lines between all points to be connected was discussed, and it was decided to hold another meeting in Joplin, Mo., on January 16th, when a permanent organization will be effected.

The association is to be conducted in opposition to the Bell company, which is extending its lines throughout the Southwest. Before the Bell people began this extension Independent companies had built systems in various towns, which have since branched out to neighboring places, and it is now proposed to unite with others, establishing prompt service, and compete for the long-distance business.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The St. Croix Power company is constructing a telephone line from Stillwater, Minn., to the falls of Apple River, in Wisconsin.

E. C. Ward of Armour, S. D., has completed a telephone line to Bloomington, Edgerton, Jasper and Wheeler.

The Wood County Telephone company of Grand Rapids, Wis., will connect with small exchanges to be opened in Pittsville, Dexterville and Babcock.

The Northwestern Telephone Exchange company has completed three toll lines in Northwestern Minnesota. One is from Crookston to Thief River Falls, one to Fosston, and one to Winnipeg Junction. Another metallic circuit is about to be constructed to Grand Forks, to take care of the heavy business.

A local telephone exchange has been opened in Hills, Minn.

A vicious fire started in the basement of the building in which is located the telephone exchange of St. Cloud, Minn. It took an hour's hard fighting to extinguish the fire. The exchange was not injured.

A mentally deranged woman caused the Northwestern Telephone Exchange company considerable trouble at Winona, Minn., lately. She called up her home in Claremont, Minn., and refused to pay the toll, claiming she had lost her purse. At different times and from different stations, she proceeded to call up Claremont or Concord, Minn. Finally she was given in charge of the police, who sent her home.

A. D. Saxton, a former lineman in the employ of the Northwestern Telephone Exchange company at St. Paul, secured a verdict of $4,500 damages against the company for injuries received from the breaking of a pole on which he was working. The evidence showed that another man had climbed the same pole before him and it had cracked under him. The foreman was informed, but nothing was done.

The Walworth County Telephone company has the new exchange at Delavan, Wis., in complete operation.

Preliminary work will be started soon by the Northwestern Telephone Exchange company at Fargo, N. D., for the new building to be erected. It is understood also that the wires in the business part of town will be buried.

The Wolf River Telephone company will establish an exchange in Green Bay, Wis., and will construct a toll line from Oshkosh to Green Bay.

The Pepin (Wis.) Telephone company will build a line from Pepin to Nelson. Connections will be secured with Wabasha and Winona, Minn.

The building of the Northwestern Telephone Exchange company in Minneapolis was sold for taxes. Owing to a faulty description in 1897, the company refused to pay the taxes. The company will undoubtedly redeem at once. The sale is but a technicality.

The Owatonna (Minn.) Telephone exchange has reported to the state auditor annual earnings of $3,584.

The Northwestern Telephone Exchange company has taken steps to have the matter of its standing in St. Paul tested in the courts. The city holds that the company has no franchise, while the company contends that it has.

The St. Croix Valley Telephone company has been granted a franchise through Balsam Lake, Wis.

Twenty-two telephone companies of Minnesota reported their annual gross earnings to the state auditor, aggregating $75,628.93. The three per cent. tax will produce $2,268.80. This is about half the companies of the state, and does not include the Bell interests.

The Northwestern Telephone Exchange company of Winona, Minn., offered to place its instruments in the police and fire stations of the city without charge, and backed it up with a petition signed by 200 people that the offer be accepted. The council turned it down without ceremony. The Northwestern is making an effort to increase its list in Winona, where it has the competition of the local system, the Winona Telephone company. The latter is about completing connections with Rochester, Minn.

The Wiscousin Telephone company does not seem to be willing to have its long-distance wires enter Marshfield, Wis., on the poles of the local company, as proposed by the council.

The Wisconsin Telephone company will make a number of improvements to its system in Fond du Lac, Wis., at once.

The Northwestern Telephone Exchange company is building a metallic circuit line from the Twin Cities south to Lime Spring, Iowa.

The Iowa Telephone company has announced a night rate for long-distance telephoning, of about one-half the day rates.

Citizens of Fonda, Ia., contemplate establishing a telephone exchange in Alta, Ia.

The Iowa and Northwestern Telephone offices in Charles City, Ia., have been united in one central office.

The Nevada (Ia.) Mutual Telephone exchange has 131 instruments now in use.

A. Harris has been granted a franchise for a local telephone exchange at Coon Rapids, Ia.

Material has been delivered at Valley Junction, Ia., for the construction of a telephone exchange.

Clarinda, Ia., is now connected with Hawleyville.

The Inland Telephone company contemplates establishing an exchange in Ellensburg, Wash., and will give the town long-distance connection.

Materials have been ordered for a new telephone exchange for Wenatchee, Wash.

The Galva (Ia.) Telephone Exchange company has completed its system and has it in working order. Toll lines are to be constructed in the spring.

The long-distance telephone line has been extended from Fort Dodge to Storm Lake, Ia.

The Red Lodge and Wyoming Telephone company has completed a line from Red Lodge, Mont., to Basin City, Wyo., 160 miles.

The Location of Telephone Poles.

In the case of the Michigan Telephone company against the city of St. Joseph, the Supreme Court of Michigan holds that the court has power to put the proper authorities in a city in motion to adopt reasonable rules and regulations by which a telephone company shall be governed in the extension of its lines, and to pass upon the validity of such action when taken, but that, it insists, is the extent of its authority, and it cannot assume the right to itself establish reasonable rules and regulations, as this is a legislative or administrative function, and not a judicial one.

As to the power of a municipality, the Supreme Court says, in the case of the same company against the city of Benton Harbor, that, under the Michigan statute, the sole authority of the municipality is the proper exercise of the police power inherent in it, to protect the public from unnecessary obstructions, inconveniences and dangers, and to determine in what manner the telephone company may erect its poles and stretch its wires so as to accomplish this result, in doing which it may go even to the extent of prohibiting the erection of poles in places and in a manner which will injure or incommode the public, but that it has no authority to impose other conditions than those warranted by the exercise of its police power, that authority resting in the Legislature—the charter-making power.

The New Order in Marshfield.

[From the Minneapolis correspondent of the Western Electrician.]

The Wisconsin Telephone company is said to have made overtures to the Marshfield (Wis.) Telephone company to connect its toll lines with that exchange. The Wisconsin company was urged to make such an arrangement over a year ago, but haughtily declined to treat with an Independent company. When refused a franchise in Marshfield it sought to string wires without the consent of the council. The matter was taken to the Supreme Court, where the old company received a crushing defeat on all points in the controversy. Now the company descends from the lofty plane and desires to treat. The council of Marshfield is desirous that the toll service should be secured, but wants it on such a basis that the Wisconsin company shall not have an opportunity to operate a local exchange. It is suggested that permission be given to string the wires on the poles of the Marshfield company.

New Exchange in Paris.

A new central telephone station is being completed in Paris. It is situated on the Rue Desrenandes, and will replace the old station on the Avenue Wagram, which has become too small for the increasing number of subscribers. The new exchange is housed in a handsome building, whose façade is of stone and enameled brick. The main telephone room is in the third story, which is lighted from above and contains the switchboards necessary for the service of the district. The new station will provide for 10,000 to 12,000 subscribers, the old one having accommodations for 4,000 only. An extensive ventilating system is provided, by which fresh air will be distributed to the upper stories by means of air tubes connected to electrically operated fans in the cellar; the air is treated by an antiseptic process. It is expected that the station will be ready for use in January. The architect of the building, M. Boussard, is now occupied with the construction of the great telephone building which is to be erected on the Avenue Saxe, near the exposition grounds.

NEW COMPANIES.

The Chicago Hotel Telephone company of Chicago, Ill., was incorporated last month. Its capital is $25,000 and its business is manufacturing telephones and electrical goods. The incorporators are William H. Hunt, Cassius O. Smith and Frank L. Clark.

The General Telephone and Electric company of New York city, organized to manufacture electric, magnetic and telephonic appliances (capital $10,000), has filed articles of incorporation at Albany, N. Y. The directors are Richard C. Weithas of Brooklyn, and J. M. Dunscomb, Frank M. Holahan and W. H. Carr of New York city.

Articles of incorporation of the Seashore and Delaware River Telephone, Telegraph and Cable company were filed at Trenton, N. J., on December 9th. The company is controlled by the Telephone, Telegraph and Cable company of America, and is capitalized at $100,000. It will build a telephone line through Jersey City, Bayonne and Elizabeth, and along the Atlantic Coast to Atlantic City and Cape May, and thence to Camden. The incorporators are James E. Hayes, Camden; George W. Beers, Fort Wayne, Ind., and John B. Stauffer, Philadelphia.

Whiteside County Stands Fast.

For four years an Independent concern, the Whiteside Harrison Telephone company, with main office at Morrison, Ill., has served the people of Whiteside County in this state, and has apparently given satisfaction. The Central Union (Bell) company is now making renewed efforts to secure control of the business and has offered to place free telephones in the county buildings as a preliminary. However, by a vote of 13 to 10, the Board of Supervisors refused to accept the offer. The Whiteside Sentinel explains the situation in these words: "The majority of the supervisors, as well as their constituents, clearly understand the object of the Bell people, which is to jeopardize and break down the business of the Whiteside Harrison Telephone company; and it is also further understood that they desire admission to the county buildings as an entering wedge in their scheme of destruction. The Bell monopoly had the users of telephones in this county at its mercy for years, and was unyielding in its high prices, being dictatorial and grasping in its methods: Relief was given by the Whiteside Harrison company—organized by citizens of the county—which reduced the rates to a reasonable price and is distinctly a home institution, reaching every city, town and village in the county and many farm residences. It has also made reciprocal business agreements with Clinton (Ia.), Lee and Carroll counties, without extra charge for the additional service rendered, and is giving better service to the telephone-using public than was ever known to have been given in the county previous to its commencing business."

EXTENSIONS AND IMPROVEMENTS.

The Chicago Telephone company has begun work on its new Stockyards exchange at 4122 Union avenue.

The Northern Michigan Telephone company of Traverse City is making arrangements to extend its line from Good Harbor to Maple City, thence to Cedar and Solon and back to Traverse City.

The Bell Telephone company is erecting a new building on North Fitzhugh street in Rochester. The structure is expected to be ready for occupancy in the spring. A new switchboard will be installed in it.

The new Massachusetts Telephone and Telegraph company, together with the Boston and New York Telephone and Telegraph company, its proposed New York connection, have engaged the entire fourth floor at 15 Congress street, Boston, for their office headquarters.

The New York and New Jersey Telephone company is making plans to extend its lines from Plainfield, N. J., through North Plainfield Township, in Washington Valley, to connect with the line that now runs from Summit to Neshanic, and expects to have the line completed by spring. Its purpose is to connect every town and hamlet within 40 miles of New York. The proposed trunk line has been mapped out over two routes in Washington Valley —one to connect Plainfield with Millington and the other to connect with Morristown and then with Millington.

It is said that of the increase in number of Bell telephone subscribers during the closing year the Erie system, under Mr. Glidden's energetic management, is to be credited with one-third. The Erie company operates in Arkansas, Texas, North Dakota, South Dakota, Minnesota, Wisconsin, Michigan and Cuyahoga County in Ohio, which includes the city of Cleveland. It hopes to have 150,000 subscribers in a year and 200,000 by the close of 1901. This means the erection of many new exchange buildings, so that when completed the company will own 65 in 45 cities.

E. D. Trowbridge, superintendent of the long-distance service of the Michigan Telephone company, states that the work on the lines to the upper peninsula is being pushed, and that the construction of the lines between St. Ignace and Marquette and Houghton is almost completed. The cable across the straits of Mackinac has been laid, and it is hoped to have connection with the northern peninsula by February 1st. The work of construction has been somewhat delayed by the shortage of material, as the demand for material has been so great this year as to make it almost impossible to meet the requirements.

GENERAL TELEPHONE NEWS.

The Central Union (Bell) company has, it is said, reduced long-distance rates between Pittsburg and Cincinnati 50 per cent.

The Mutual Telephone company of Des Moines has notified the Edison Light company to remove its wires from Mutual poles. It is claimed the induction caused by the electric-light current is such that it impairs the service of the telephones.

In Canal Dover, O., there is a clash of Bell and Independent interests. The Independents offered rates of $12 and $24 per annum, and then the Bell people said that they would cut their rates to $9 and $21. This threat has not frightened the anti-Bell company, which promises a fight to a finish.

Some Suggestions to the Managers of Small Central Stations.[1]

By Geo. Hayler, Jr.

At the close of the year 1898, there were in operation in the state of Ohio, 173 central stations, and of their number 88, or more than 50 per cent., were located in towns having a population of 5,000 or less. Many of these stations have been in operation for from five to 10 years, and have had to suffer from the lack of engineering ability displayed in their design and construction. Some have already outgrown their original equipment and have been rebuilt in more modern lines; others, having striven unsuccessfully to make both ends meet, and satisfy the Village Council at the same time, have ingloriously given up the fight and have been succeeded by that bugaboo of small stations, the municipal plant. Many of the small stations that have been built within the last few years are fortunate in having apparatus modern in design and economical in operation and have been installed by men whose knowledge of the conditions to be met has put them in a fair way to return a reasonable interest on the investment; but there are still a large number of small plants, poorly designed in the beginning and equipped with old apparatus, that have persistently refused to pay dividends in the past and whose future looks far from brilliant, and it is with these that we are concerned.

Much has been written in the last few years regarding the economies to be effected through proper central-station design, and the advantages to be gained by replacing old apparatus with new and more modern machinery, and if it were always possible to carry these suggestions into effect, as applied to our particular case, the result would undoubtedly be favorable. There is no question that, if we had it all to do over again, we could improve matters very much; but it is simply out of the question to throw away thousands of dollars' worth of equipment, and the average manager of a small station must content himself to take conditions as he finds them, and by judicious additions and alterations in his plant, necessitated by increased business, gradually work out his salvation.

The problem, then, which confronts the manager is this: Given an electric-lighting plant in a small town—how to increase the net earnings without resorting to any radical changes in the installation. There is always room for improvement, and with this idea in mind, I have undertaken the preparation of this paper, hoping that perhaps I may suggest some idea as the result of my limited experience which may prove of value to someone similarly situated; and if I do, the purpose of this paper will have been accomplished.

Let us consider for a moment the conditions to be found existing in the average small lighting plant. We have a town, say, of from 4,000 to 5,000 people, with, perhaps, both gas and electric companies doing business. The electric plant has probably a typical equipment, consisting of one or more series arc machines, and, the chances are, an alternator. Engines and boilers have seen hard service, but, on the whole, the machinery is in fair operative condition and capable of doing good work.

The lines, perhaps, show marks of time and extension; having been made without due consideration as to the best arrangement, they will probably bear considerable attention. The transformer equipment, is is likely, consists of a number of small units operating at a secondary pressure of 52 volts, or perhaps, if the station has been built since 1892 or 1893, at 104 volts. The chances are that the plant has still considerable reserve capacity, or if it has not, there is a certain amount of unprofitable business, which must be gotten rid of entirely, or else put on a paying basis.

Now, it is evident that if the net income is to be increased, it must be done by first increasing the total gross earnings through taking in more customers; second, by reducing operating expenses. It is to the first of these requirements that I wish to call your attention more especially.

It is a regrettable fact that in small central stations the cost of operation does not bear any definite relation to the value of the total output. In every station the fixed expenses, such as taxes, insurance, interest, etc., remain the same under all conditions. The item of labor, however, in a small station is also practically a constant quantity, and the cost of fuel, water, carbon, lamps, removals, etc., while bearing a closer relation to the output, are not proportional to it.

It is evident, then, that as we increase our station output up to the economical working limit of our machinery, assuming the selling price per unit to remain constant, we increase the net profit in each unit of electrical energy produced.

The question now arises: How are we to increase our business? Let us consider for a moment the essentials for the increase of any manufacturing business. In the first place, there must be a demand created for the manufactured article. If it is something new and has the field to itself, it must be advertised and the public educated to feel the necessity for its use. If it is an article to compete with other articles of the same nature, in order to sell, it must be better or cheaper, or more convenient than that which has heretofore been produced. So it is with electric light; in order to interest new customers the customer must first be convinced that some material advantages will be the result of its use.

Before we can compete with other forms of illumination, however, we must be able to assure our customers of these things: First, reliability of light; second, quality of light, and third and last, cheapness of light.

There is perhaps nothing more detrimental to the success of a lighting business in a small town than frequent irregularity of service. This is undoubtedly due, in a large measure, that very few small plants have sufficient reserve apparatus to tide them over any accident of a serious nature, and accidents will happen, even in the best conducted stations. It has been my experience, however, that accidents are usually the fault of someone's carelessness, rather than visitations of Providence, and that many of them may be avoided, provided that the employes of a station exercise due care and diligence in the discharge of their duties. The duties required of the average man employed about a small plant are varied in the extreme, and require much good judgment and a large capacity for hard work and long hours. It is a mistake to suppose that anyone who is familiar with steam machinery will be the man to operate an electric plant. It is hard to teach an old dog new tricks, and it will probably cost you more to teach an erstwhile engineer of a threshing machine or a sawmill how not to do things, than it would be to take a green man and teach him how things ought to be done. Don't make the mistake of employing one of those men who know it all and who has his pockets full of credentials from plants where he has been employed. A letter of recommendation is often a mighty cheap price to pay for the privilege of disposing with a man's services. Shun, also, as you would the Old Nick himself, the man who is continually and eternally skipping around with a monkey-wrench in one hand and an oil-can in the other, adjusting everything in sight. He will make you nervous, and eventually cause you more trouble and expense than a man who sits down and deliberately neglects things until they will run no longer. Get good, sober, cool, reliable men, and then keep them; and if you can't find the men you want, get some good, young raw material and make them. It will take time and patience, and you will get your hands dirty, but in the end you will have men whose reliability, carefulness and loyalty will pay you a thousands times over for the time and patience spent in developing them.

Instill into the minds of your men the fact that your interests are their interests, and that you must all pull together or not at all. Try to arrange the work so that each man has certain specified duties, and hold him strictly accountable for their performance. Give the workings of your plant a share of your personal attention. Try to familiarize yourself with the smallest details, and insist that in case of anything being wrong with your machinery, that you be acquainted with the fact at once. Go over your lines once in a while, and see that the trees are trimmed. Avoid, as far as possible, building any line on the streets, but keep in the alleys. Spend a few dollars for lightning arresters, and insist on careful inside wiring, so that every time there is a thunderstorm you do not lose a half-dozen transformers. This last point is one often sorely neglected in small towns. The interior wiring is usually something fearful and wonderful to behold. It results from the attempt to do work too cheaply and by intrusting it in unskilled hands. This is a very serious mistake and will eventually cause both the lighting company and the customer an endless amount of trouble and annoyance. The main cost, then, of continuous service is eternal vigilance.

The next consideration which the use of electricity for illuminating purposes involves is that of quality of light. This is a very important point, and one in which small stations, as a rule, are great sinners. Two of the most salient features of good electrical illumination are steadiness of light and uniformity of candle power, and unless these can be maintained, the value of the electric lamp, as a source of illumination, is virtually lost. Let us consider, briefly, first, the causes for poor quality in the arc light.

Poor arc-light service has been the ruination of many and otherwise promising electric-light enterprises, and has been the source from which have sprung many of the municipal plants found in small towns. The series-arc lamp, at best, is a rather rude piece of mechanism—simple in construction, but still capable of cutting up the most uncalled-for capers, just at a time when it is least desirable. It is subject to numerous diseases which have their origin, like most of the diseases which afflict mankind, in dirt and neglect. Its care is usually entrusted to the tender mercies of the most poorly paid men about the plant, and, exposed to the dust and rain, forming an ideal roost for the pesky sparrow, it is no wonder that it insists on having its wants immediately attended to, by refusing to make even a spark. Insist, then, that your trimmer keeps the lamps clean. When the lamp is really out of order have it brought in at once and repaired. Don't try to tinker it up and wait to see if it will burn that night. The chances are it won't, and you will have two nights' rebate to pay, instead of one. Do not buy the cheapest carbons that you can get hold of, for they will probably be crooked and as knotty as an Irishman's shillalah, and your lamps will burn more like a Fourth of July exhibition than like good, steady arc lights. If you have a voltmeter, try your lamps and see what the voltage is across the arc. An experienced man will adjust a lamp to a nicety, without resorting to this expedient, but just try it anyway. You will be astonished at the variation in the voltage, and you will perhaps find that many of your lamps are taking 700 watts, instead of 450, while others are not up to the standard. Put your station ammeter in circuit once in a while, and see how much current you are applying to your lamps. Many a plant has gotten itself into serious difficulties by carelessness in this regard. Try and keep everything in the best possible shape, so there will be no possible chance for complaint; for there are always so-called experts roaming around with plans for a municipal plant in their pockets, who are looking for just such shortcomings.

The quality of incandescent light depends, primarily, on the regulation, and is affected to a great extent by the quality of the lamps used. The secondary voltage in an ordinary small plant will be found, by making a voltmeter test, to vary from six to 15 per cent. This seems almost incredible, but, nevertheless, is true, and is the natural result of the methods of transformer installation in vogue up to the last few years. Among the earlier alternating plants installed, 52 volts was the standard secondary pressure. This pressure was adopted, mainly, because the 52-volt lamp will stand greater extremes of voltage without serious deterioration than will the 104-volt lamp. It was necessary in distributing this pressure to use a number of small transformer units, because the cost of copper practically prohibited the extension of secondary mains over any considerable area. This condition of affairs gives rise to the very poor regulation to be found in plants of this nature, for while some transformers are fully loaded, adjacent ones may be carrying a very light load; and a consequent variation in voltage, due to copper losses and magnetic leakage is the result. In the attempt to give a good light to the customer, who is connected to the heavily loaded transformer, by increasing the primary voltage at the station, the pressure on the secondary of the lightly loaded transformer is increased much above normal, in consequence of which any lamps that may happen to be burning have to suffer. It is evident, then, that if we could interconnect our transformers, so as to equalize the voltage between them, we should get very much better results in this regard. Further, if we should now replace our several transformers by one large transformer, located in the center of distribution, we should still retain the advantages to be gained in regulation, besides, at the same time, reducing our core losses very materially. It is quite evident, however, that the cost of copper would preclude any possibility of distributing from a large centrally located transformer at a secondary pressure of 52 volts. By increasing our secondary voltage to 104, we can cut the cost of copper to one-fourth, and by using 208 volts, we can reduce the cost to a little over one-sixteenth; the percentage of drop in the lines remains the same in all cases.

Much data has lately been published in regard to this matter, and it behooves the manager of a small station to look into the question carefully. It not only means that his customers will get better service by the adoption of larger transformer units and higher secondary pressures, but at the same time the core losses, entailing more or less waste of fuel, will be materially lessened.

During the summer just passed, the company with which I am connected was compelled, by city ordinance, to remove its poles and wires from the business streets and to rebuild them in the alleys. This change necessitated an entirely new arrangement of circuits, and we determined to take advantage of the occasion and try to improve our service. In one particular district, comprising three blocks of business rooms, the lamps were formerly supplied by nine transformers, varying in size from one-half to five kilowatts, and having an aggregate capacity of 465 lights. The secondary pressure was both 52 and 104 volts, and by actual measurement there was at times a variation in voltage of six per cent. between adjacent buildings. The total number of lamps in circuit aggregated 892, of which 179 were on contract and 513 on meter. One hundred and fifty of these lights were in stores closing at 6 p. m., except on Saturday; 100 were in a church, and the balance were distributed among business rooms and offices. The load was heaviest almost in the center of the district, with the church on one end and the consumers gradually becoming fewer toward the other end. The question now was, whether to use the old transformers, and connect them together with a heavy secondary tie-wire, or whether to buy several large transformers wound for 208 volts, and use a three-wire system. It proved, on doing a little figuring, that a No. 2 feeder would be necessary to connect the transformers with the pressure at 104 volts, in order to avoid a drop of over two per cent. at full load. The total distance to be covered was just 1,000 feet, and the cost of the wire figured almost exactly $100. By using a three-wire system, 208 volts on the outside and larger transformers, the length of some of the runs was increased, but it proved that a No. 4 wire would be amply large enough to carry the load and allow a good margin for increased business. The cost of this wire amounted to $65.40, and that of the neutral wire $15.75, or a total of $71.15, a saving in wire of $19.

There was another thing taken into consideration,

1 Read before the Ohio Electric Light association, Cleveland, October 10, 1899. Mr. Hayler is manager of the Van Wert (O.) Electric Light and Power company.

however, and that was the question of core losses of the nine transformers; six were of 50 lights' capacity or less, and had been in service for some years, and the probabilities were that their efficiency was pretty low. We had no opportunity of measuring our core losses, but from some published data from some tests made by Professor Jackson on transformers of the same type, and of about the same capacities, we estimated our core losses to be not less than 650 watts. We finally decided to install one 250-light transformer and two 100-lighters of modern design, and we were safe in assuming that the core losses would not aggregate over 360 watts, a net saving of 290 watts per hour; which, if we assume our cost per kilowatt, delivered at the transformer company, to be somewhere in the neighborhood of four cents, will amount to about $40 only. This is pretty good interest on the cost of transformers, and besides this we have the old ones, which we can use if we want to.

Another fruitful source of poor light is the use of poor incandescent lamps, but this point has been brought about so often, that I need say nothing further than that the best lamps are none too good, and that the difference in cost between good lamps and poor lamps is so small as to be compensated many times over by the increased excellence of the service to be obtained, to say nothing of the economies effected in the coal-pile.

The third requirement for the increase of our business is low cost of light to the consumer. The question of rates to be charged for electric-light service would furnish material for several papers, and I can but touch upon it here. In a small plant, having no gas competition, the rates will be governed largely by the customary charges for similar service in towns of corresponding size. It is absolutely necessary, however, that the matter be looked into very carefully. Local conditions may greatly affect the cost of manufacture, and it may cost more to furnish light in one town than it will in another perhaps 50 miles away. The price of coal is one of the largest factors in the extensive operation and is exceedingly variable in quantity, due to the difference in freight rates. The quality of the feed-water used will also have a great bearing on the efficiency and life of your boilers, and perhaps, owing to the peculiar manner in which your town is laid out, the investment in copper necessary to be distributed over it may be several times that required in a neighboring town of the same population.

In towns where we have gas competition the question assumes a different phase. Here the price in regard to service has a fixed limit, above which it is almost impossible to go and be successful. The advent of an electric company into a small town is usually the occasion of lowering of gas rates in the hope of discouraging electric light. And the first clash of arms is likely to be prolonged into a rate war, which will continue until the companies get together and make some kind of a working arrangement by which both can live, or else consolidate their interests.

In considering the advisability of lowering rates the first thing to be taken into account is the strength of your adversary. How long can he hold out at the prices which he will be compelled to make in order to meet your competition? A point not to be overlooked is the fact that lowering rates will be accompanied by increased consumption, and owing to local conditions your adversary may be able to make more net profit per cubic foot of increased gas consumption than you can make on an equivalent of increased electrical consumption; and if this is the case, your last state is worse than the first. Try to avoid, if possible, ruinous competition. Above all things, do not make the mistake of charging a half-dozen prices for the same amount and class of service. It will cause you more trouble and lose you more customers than any other policy which you might adopt. Confidential rates are a bad thing to trifle with, for in the end they will prove to be a boomerang.

The question now arises, what is a fair rate? It is generally accepted throughout the eastern and central states that on meter measurement a base rate of 20 cents per kilowatt-hour is about correct. Let us see for a moment how this compares with the price of gas. An ordinary gas-jet consuming five cubic feet of very good gas hour will, on the average, give from 18 to 20 candle power. A Welsbach lamp, when in good condition and consuming three feet of gas per hour, will give about 40 candle power. Then 1,000 cubic feet of gas will produce with ordinary open-tip burners not to exceed 4,000 candle power hours, and with a Welsbach 13,300 candle power hours, or a little over three times as many. In order to produce the same amount of illumination with a 16 candle power incandescent lamp the lamp will have to burn respectively 250 and 832 hours. Assuming that the consumption of an average lamp to be 60 watts per hour, we should have to expend, in the first case, 15 kilowatt-hours, and in the second 50 kilowatt-hours. Now, if the price of gas is $2 per 1,000 feet, for an equivalent of light we shall have to sell 15 kilowatt-hours for $2, or at a rate of 13½ cents per kilowatt-hour, while in order to compete with Welsbachs we shall have to sell current at a rate of four cents per kilowatt-hour, a rate which is practically out of the question at small stations.

In the majority of small towns, however, light is sold on a contract basis, and we will consider briefly the advisability of modifying this system to the benefit of both the company and the consumer. From the records of our station I find that between the hour of starting the machinery and 10 o'clock p. m., the average number of hours run per month is 140. We can safely assume, then, that with contract lights the hours of burning will approximate this figure. Now, at 13½ cents per kilowatt-hour, a lamp burning for 140 hours, and taking 60 watts per hour, will cost the consumer $1.12. If it is burned until nine o'clock, or 112 hours per month, it will cost 89 cents, and if until eight o'clock, or 84 hours, it will cost 66 cents. It would be out of the question, however, in most towns, to charge such prices for lights on contract, and it will be readily seen that for several reasons we can afford to make the rates much lower. In the first place, the customer having, say, 10 lights in his store, and closing at 9 p. m., would not, if they were on a meter, burn them for anywhere near 112 hours each month. This would be especially true in the summer time, when there would perhaps be no necessity for having them all turned on before 7 p. m. The result will be that, instead of paying $8.90 per month for his light, he will probably not pay more than $5.00. At the same time the cost to the company furnishing light would remain nearly constant; for interest charges, labor, etc., remaining nearly the same, the only difference would be in the cost of coal, wear and tear, etc., and this would be offset in a measure by the interest on the cost of meters, their maintenance and the advantages to be derived by avoiding disputed accounts. Again, if the customer is on a contract, he is bound to take light for a specified period, and in consequence the electric-light company is assured of a certain definite revenue from him; while, perhaps, if he were on a meter he might take a notion to burn gas at times, and would prove a very unsatisfactory customer.

On the other hand, in competing with gas for the illumination of residences, public halls, churches, etc., requiring intermittent use of light, it is necessary to furnish an illumination equivalent to the gas—that as many or more electric lamps be installed as there are gas-jets in use. It is necessary also that we make a rate comparable with the cost of gas for similar service. Obviously, then, the rate per lamp must be made much lower than in the case of strictly commercial lighting; if, now, we could assure ourselves that the lights will be used judiciously, or only when necessary, we can perhaps get a fair price for current furnished, but the chances are very much against such conditional affairs; and the consequence is, that there will be an enormous waste of light, for which the company will receive no compensation, and which waste will occur just at a time when the light has its maximum value to the producer. I know that in the case of the plant with which I am connected we passed through a similar experience. The load kept increasing until the capacity of our machine was strained, while at the same time the revenues remained unsatisfactory. A partial change to the meter basis—more especially in residence lighting, churches, public halls, etc.—resulted in cutting the load almost in two, while the revenues, after a temporary drop, soon increased again above what they were before the change was made.

I think, then, that in the case of small stations it is safe to say that for commercial customers, using perhaps up to as high as 10 or 15 lights almost constantly during lighting hours, the contract system is preferable. But in installations requiring a large number of lamps, where it is not necessary to burn them continually, the contract system results in a great waste of light; and in such cases the meter system is the best solution of the difficulty, and even this has its faults. Electric light has some features peculiar to itself which make it almost the ideal form of illumination. It is clean and cool, does not vitiate the atmosphere, and its quality is such as to make it particularly valuable for distinguishing colors after night. It also lends itself admirably to decorative effects, and can be used under circumstances where other forms of illumination are entirely out of the question. All of these advantages tend to make electric light bring a premium over the price charged for gas lighting for many purposes, and should be used as arguments in persuading customers to take light. Decorative lighting may seem a very unprofitable field in a small town, yet it is a good form of advertisement for the company. Window lighting is also a very profitable field, and although one would not expect much from this source in a small town, yet it is surprising at the revenue to be obtained from it. Handling electric and combination fixtures has also been the means of obtaining us many good customers. We do not attempt to make much profit out of the business, but try to do good work and please our customers, and the result is, that they very rarely leave us, after once experiencing a convenience of having electric light scattered freely throughout the house, and capable of being turned on and off without groping around in the dark to find a chandelier.

The second requirement for the increase of our net income is the reduction of operating expenses. This phase of the question has received so much attention lately, both in the columns of the technical papers and at the meetings of various lighting associations, that anything I might say would be simply repetition. The subject was handled most admirably at the last year's meeting of this association by Mr. E. P. Roberts in his paper, entitled "Positive and Negative Economies in the Operation of Small Electric-light Plants." If it were possible to emphasize any of his statements, I should first call attention to the necessity of keeping close account of everything that goes to make up the operating expenses. Keep books. It is not such a tremendous amount of work; and don't be satisfied with simply an account of receipts and expenditures. It is just as necessary for the manager of a small plant to know where his money is going as it is for the manager of a large plant. Keep daily station records of the number of hours run, the load in arc and incandescent lamps, the amount of water consumed, the amount of coal burned, and of the dozens of little and big things that go to make up the expense account. You would think your fireman crazy if you saw him shoveling dollar bills under the boiler, yet perhaps that is just what he is doing for you, only in another way. Weigh your coal and water once in a while, and see about what you are doing; perhaps your coal is unsuitable for the work required of it; perhaps your fireman does not know as much about firing as he should; check him up and see. You will be surprised at the amount of interest that your men at the station will take in these matters. If they are the right sort of men they are interested in your success, and are willing to do their best to help you if you can only tell them what to do.

Know the conditions thoroughly under which you are working, and then knowing them, try to improve them to the best of your ability. You may have difficulty at times in raising the necessary money with which to make changes and improvements; but you do not need to make them all in a day; do it gradually. Rather than spend a little money in tinkering things up so they will work for the time being, get at the root of the difficulty and fix it up once and for all, even if it does cost more.

Above all things avoid buying things on which your service depends because they are cheap. I do not mean to say that one should always buy the most expensive supplies, but he should use good judgment, strive to buy the best and most suitable for his purpose.

And, finally, do not make the mistake of being too economical in your pay-roll. The laborer is worthy of his hire, and if you have a good man show your appreciation of him by paying him what he is worth to you.

In conclusion, I would say, study the conditions peculiar to your town and your plant; become familiar with every detail; get out once in a while and see your brother managers and have a chat with them and see what they are doing. Keep posted in current affairs in the electrical business and strive to insure that your customers have as reliable service, as good light and as low prices as it is possible for you to give them.

Wood Arc Lamp Suspension Cutout.

To supply the demand for a reliable as well as ornamental suspension device for cutting in or out arc lamps for interior illumination the Wood arc-lamp suspension cutout has been designed. This device is furnished in any length, so as to permit the suspension of the lamp at any desired distance from the floor. In the illustration the device is shown in position. The switch mechanism of the cutout is so arranged that when the black handle is pulled the light is extinguished and the lamp and its terminals disconnected from the circuit, thereby avoiding the possibility of shock to the trimmer. When it is desired to light the lamp the white handle is pulled, which immediately places the lamp in the circuit. The switch mechanism is quick-acting in both directions, and after passing a given point is entirely beyond the control of the operator, making a positive "on" or "off" contact.

The switch lever is so designed that its center of gravity is below the point of support, thereby allowing it to remain always in a perfectly horizontal position, preserving the symmetry of the design. These devices are neat in appearance, dustproof and finished in antique copper, brass, black or any other finish to suit the lamps which they are intended to be used with. They are also fitted with a pointer which indicates the "on" and "off" positions. The line terminals are connected to two binding posts on the outside, which are visible in the illustration, while the lamp terminals pass up through the hollow hook and are connected to two binding posts on the inside. All connections can be made without removing the lamp from the hook. The method of working the switch mechanism by cord and tassel, pole or hook in a vertical plane is said to be a great improvement over the horizontal-

plane method, which makes it very difficult to throw the switch when the lamp is installed any great distance from the floor.

These lamp-suspension cut-outs are manufactured for use on constant-potential circuits, as well as series circuits. The interior mechanism, however, is slightly modified, so that the circuit is open while the lamp is cut out, instead of being closed, as is the case when used on series circuits. The Fort Wayne Electric Works, Fort Wayne, Ind., are the manufacturers of this new device.

The Warren Electric Manufacturing Company's "At Home."

The public test of the largest dynamo yet turned out by the Warren Electric Manufacturing company of Sandusky, O., was the occasion, on Friday afternoon, December 15th, of an "at home" at the works of the company to the citizens of Sandusky. From two until five o'clock the doors of the works were thrown open to visitors, and, guided by different officials of the company, the guests, many of whom were ladies, were shown about Mr. Warren's plant. The various points of interest in the shops, and the large new dynamo, in particular, were explained to those who were so fortunate as to devote an hour's time to a most interesting subject.

There were present to receive and conduct the visitors about the establishment C. C. Warren, president and general manager of the company; Frank Warren, secretary; Charles F. Mack, treasurer. Assisting these gentlemen in explaining some of the mysteries and intricacies of the electrical machinery were C. E. F. Ahlm, chief electrician; A. Lang, chief draughtsman; Carl Rieger, receiving and shipping clerk; Hale Robinson, general superintendent; F. A. Fish, chief accountant, and others.

The objects of greatest interest were the three alternating-current dynamos that have just been built for the Armour plant at the Union Stockyards in Chicago. One of them is 10 feet in height, weighs 25 tons and is of 7,000 incandescent lights' capacity. The two other dynamos built for Armour are of 3,500 lights' capacity each. Besides the machines for Armour there were 25 or 30 other dynamos of various sizes and patterns in all stages of construction in the shops. Several of the Warren alternators have been sent to Japan, and another order from a firm in that country was recently booked. In Mexico and Canada machinery from the Warren shops is also used.

The Warren company purchased the plant that it now owns three years ago; and a played-out and run-down business in another line and a dilapidated old shop have been converted into a model electrical establishment.

CHRISTMAS PRESENTS.

Motormen and conductors running out of the West Side barns of the Chicago Union Traction Company were furnished with hot turkey dinners on Christmas Day by the company.

Every man in the employment of the Cleveland (O.) City Railway company, popularly known as the "Little Consolidated," except the track men and laborers, received a $5 gold piece as a Christmas present from the company. In all the company distributed $5,000, all in gold.

The "compliments of the season" from the Joseph Dixon Crucible company of Jersey City, coming in the shape of a box of lead-pencils and erasers, are always especially welcome in newspaper offices. The Western Electrician acknowledges the receipt of such a box with thanks.

Seventy telephone operators employed by the Chicago Telephone company at the main office, Washington and Franklin streets, were pleasantly remembered by the company on Christmas Eve, says the Chicago Record. Each of the 70 girls received a $2.50 gold piece as she concluded her day's work, and all were complimented by their superiors for their bravery and coolness a few days ago when a small fire was discovered in the building.

The Western Electrical Supply company of St. Louis has sent out to all the trade as a Christmas remembrance a handsome souvenir in the shape of an aluminum pocket cigar case, filled with good cigars—a useful as well as entirely satisfactory present to most men. The company states that its business in every department has far exceeded its greatest expectations, and, wishing to thank its numerous customers, it thought that this method of getting to all of them would be the most acceptable. Probably no supply house in the country has grown so rapidly and solidly as this company. Its policy of giving all orders, whether small or large, the best attention has, they report, succeeded in the long run, and to-day, the company stands in the front rank, as one of the largest supply houses in the country, with a reputation for integrity and business ability that is enviable. The company reports that the outlook for business in 1900 is extremely good.

The Iron Clad Resistance company of Westfield, N. J., is distributing to the trade a unique souvenir in the form of a paperweight, which is an exact reproduction, in miniature, of one of the types of ironclad rheostats made by this well-known company. The iron body of the paperweight is finished black, while the contacts and lever are in lacquered-gold finish. The Iron Clad company says that it has about completed a large two-story addition to its works, and will now have practically double the manufacturing floor space which it had when the company commenced business a little over a year ago. This addition was necessitated by the large and increasing orders for standard and special rheostats and theater dimmers, which it reports are constantly being received from this country, as well as abroad. The policy adopted by the company, which is to furnish only first-class and reliable apparatus at fair prices, seems to have met with the generous approval of the users of rheostats, and undoubtedly will continue to keep the company in the front rank in its special line.

CORRESPONDENCE.

New York Notes.

New York, December 23.—Brooklyn Rapid Transit stock suffered on the stock market to a considerable extent early in the week. The greatest break was a decline of nearly 14 points on Wednesday, but the fall was only temporary. There were stories which went with the decline, which included a rumored intention of having a receiver appointed for the property, a marked decrease in the earnings of the company, and the liquidation of stock held by one of the strongest interests of the corporation. The positive and direct denials of the truth of these stories by officials of the company served no purpose in the time when hammering was hardest. Officers of the company said not only were earnings showing considerable increase over the corresponding period in last year, but that the talk of a receivership was not only unfounded but libelous. As to the liquidation by one of the principal holders of the stock, this was also denied; but all of the indications point to the truth of the report. The voting trust in Brooklyn Rapid Transit will expire December 31st and the voting-trust certificates will be exchanged for Brooklyn Rapid Transit stock. The annual meeting will be held January 26th, and the result of that meeting will undoubtedly show who own and control the company.

The Automobile Club of America has decided to compete for the James Gordon Bennett automobile cup at an international race, to be run near Paris, and the formal challenge has been mailed to the Automobile Club of France. Among the other probable competitors are the national automobile organizations of Austria, Belgium, Germany, Great Britain, Switzerland and Turin. Each club is entitled to start three vehicles, and it is probable that America will be represented by the full complement. Two members of the club have already decided to build automobile racers especially for the contest. The distance of the race will be about 450 miles, and it will take place on the French roads some time between May 15th and August 15th.

Controller Coler's rapid-transit tunnel plans received a serious check at the hands of the Municipal Assembly Tuesday night. The aldermen defeated the controller's suggestion to look into the cost of tunnel construction from Whitehall street to Brooklyn and the mayor signed the resolution authorizing the bridge commissioner to investigate the erection of the proposed bridges from Sixtieth street to Long Island City and from Pike Slip to Brooklyn. Controller Coler believes that the tunnels will solve the question of transit between Manhattan and Kings and Queens.

It is probable that next Tuesday Third Avenue Railroad electric cars will commence running in Amsterdam avenue between One-hundred-and-twenty-fifth and One-hundred-and-sixty-first streets. The cars will run through from the postoffice to One-hundred-and-sixty-first street. They will not run to Fort George, however, for five or six weeks.

Plans have been submitted to the Park Board by officials of the Manhattan Railway company, showing routes of the elevated railway by means of which it can reach the South Ferry terminus either without crossing Battery Park or with structural modifications, which, in combination with shrubbery, would partly conceal the structure where it encroaches upon the park. It is expected that the plans will be considered by the board next Wednesday.

It is reported that a torpedo has been perfected by a New York woman which may work great results in naval warfare. The woman is Dr. M. J. Alsbau. In its undeveloped state the torpedo was invented by Captain T. Wemyss Just of Tasmania, who has been living in New York for a year. Dr. Alsbau is said to have worked out an electrical apparatus for steering the torpedo without having wires connecting it with the boat from which it is sent. However, the idea of using electric waves for this purpose is also credited to an English inventor. The United States government has become interested in the new torpedo, it is said, and will advance $10,000 for experiments, the inventor having raised $40,000 in cash. A stock company has been formed, capitalized at $1,000,000, to manufacture the new projectile. When fired the head of the torpedo is to strike the enemy's ship above the water line, flying off in advance of the torpedo proper. This is intended as a feint. Just after it has exploded the huge torpedo explodes underneath. It is guided by a device based on the laws of gravity. M. L. G.

Northwestern Notations.

Minneapolis, December 23.—A controlling interest in the Cedar Rapids (Ia.) Electric Light and Power company's business has passed into the hands of C. J. Ives, Dr. J. H. Smith and others.

A. L. Beardslee has applied for an electric-light franchise at Manchester, Ia. The city will vote on the proposition on January 20th.

The new street railway has run its first car in Council Bluffs, Ia. Construction is being pushed as rapidly as possible and it is expected to have the line in operation by January 1st or soon after.

City Electrician William H. Dickman of Rock Island, Ill., was working on an electric-light pole, when it snapped under his weight. He fell 20 feet, the pole falling on him. He was painfully bruised, but it is thought that nothing serious will result.

A fierce snowstorm in La Crosse, Wis., tied up the street-car system completely for nearly 24 hours.

W. S. Clem proposes to establish an electric-light plant in Chelsea, Ia., in the spring.

The council of Mankato, Minn., granted the street-railway company an extension of time in which to get the system in operation. The mayor vetoed it, but the council overruled his veto, despite his vigorous efforts to prevent it.

The G. & D. Electric Supply company of Sioux City, Ia., has filed articles of incorporation, with $10,000 capital stock.

Superintendent Hurd of the street-railway company at Janesville, Wis., says the company is paying expenses and making a small profit on the investment this winter. A number of improvements are in prospect for next season.

A new 60 horse power boiler has been added to the electric-light plant at Winterset, Ia., at a cost of $800.

The electric-light system at Winnebago City, Minn., is in a flourishing condition, and is adding to the number taking light so much that an additional dynamo will be necessary before another season.

The Home Electric company of Dubuque, Ia., is unwilling to accept the franchise tendered by the council. It provides for transfers to all lines and for half rates between six and seven in the morning and evening. The council declines to authorize any extensions unless these conditions are complied with.

A new dynamo has been installed at Madison, Minn., for the village electric-light plant.

The Twin City Electric company of Grand Rapids and Centralia, Wis., has adopted a new schedule of rates.

Electric lights are projected for Blanchard, Ia., for next season.

The matter of municipal ownership of the electric-light plant is being agitated at Platteville, Wis.

The council of Chaska, Minn., has taken the first step looking toward the installation of a village electric-light plant.

The report of E. P. Roberts & Co. of Cleveland, O., on the cost of installing and operating an electric-light plant for Duluth, Minn., has been received. For a plant of 460 arcs, of 2,000 candle power, the cost is $93,000; for 500, it is $97,000, both to have a gas-power plant at the gasworks. For 460 lights with steam-power plant, the cost is $110,500; for 500 lights, $114,000. For a steam-power plant at the pumping station the cost of 460 lights would be $114,500, or $118,500 for 500 lights.

The Montana Power Transmission company has been incorporated at Butte, Mont., with capital stock of $1,000,000. It succeeds to the water power and electrical transmission plant being installed on the Big Hole River.

A breaking governor on the engine in the electric-light plant at Mankato, Minn., crushed the jawbone of the night engineer, Joseph Hampel, cut his neck, fractured his skull and otherwise injured him. The flying pieces also did considerable damage to the room.

The Electric and Power company of St. Cloud, Minn., recently notified the Benton Power and Traction company that it would be compelled to shut off the power from the street cars. The Benton Power and Traction company is installing a new power plant, which is not quite ready. The former company has added to its customers, so that its capacity was exceeded by the demands of the street-car company. Coming at the holiday period, the stoppage seriously inconvenienced shopping. A compromise was finally arranged by which the cars were furnished with power from 6 to 7:30 a. m. and from 4 to 6:30 p. m.

The street-railway company of Fond du Lac, Wis., has made its peace with the Chicago and Northwestern Railway company, and the latter will permit the street-car tracks to cross its tracks.

The Edison Light company of Des Moines, Ia., has just installed additional machinery, which doubles its capacity.

The street-railway company of Des Moines has purchased two 600 horse power engines, which will be installed in its power plant at once.

The employes of the St. Paul Gas Light company presented B. F. Ellison a testimonial of regard. Mr. Ellison is leaving the Gas Light company to accept the management of the Waterworks, Gas and Electric company of West Superior, Wis. The present was a bronze figure-piece, representing Progress and Science.

F. H. Snyder will install a complete electric-light plant for the Saulpaugh House at Mankato, Minn.

The contract has been let for a $20,000 electric-light plant at Greenwood, B. C.

Negotiations are pending at Dubuque, Ia., for the consolidation of the street-car systems into one company.

Dr. D. K. Dickinson of Lead, S. D., has bought the electric-light plant at Spearfish, S. D. It is rumored the purchase is for the Homestake com-

pany, which is buying all the water rights possible along the Spearfish Creek, and the electric company had rights on that stream.

The Burlington Railway and Light company of Burlington, Ia., seeks to enjoin a tax sale. It claims that the city agreed to release the company from paving between its tracks in consideration of certain extensions and other improvements.

Several years ago the street-railway system at Keokuk, Ia., was sold at auction to J. C. Hubinger of that city for $10,000. He made extensive improvements and operated it. The Central Trust company, representing bondholders, appealed from the sale and the Iowa Supreme Court reversed it. Action was then brought in the federal court against Mr. Hubinger for the conversion of property, and judgment for $27,000 secured. The judgment was paid and the Superior Court has now apportioned the proceeds of the judgment to the bondholders.

The Supreme Court of Minnesota holds that the burden of proof falls upon the plaintiff to show that a defendant company is negligent in case of an accident, in failing to employ a conductor on a street car. The case was James Palmer vs. the Winona (Minn.) Railway and Light company.

The council of Missoula, Mont., has contracted with the Electric Light company for lighting the city for five years at $8.33 per arc light per month.

The contract has been let and work started on the Seattle and Tacoma electric railway. The line will cost about $20,000 a mile.

The Dickinson (N. D.) Electric Light and Power company has been incorporated, with $10,000 capital stock, and will proceed to install a plant at once.

The county commissioners of Swift County, Minnesota, are considering a small electric-light plant for the courthouse at Benson.

The Holt electric plant will begin lighting the streets of Oconto, Wis., about December 15th.

The Omaha and Council Bluffs Railway and Bridge company and the Council Bluffs and Suburban Railway company have each secured injunctions against the other, to prevent laying of track in disputed territory. The former has also asked and secured an injunction to prevent the latter from laying any tracks on streets occupied by it. The charge is made that the Council Bluffs and Suburban secured its franchise by fraud.

The one dynamo in the village electric-light plant at Fosston, Minn., is said to be overloaded, and a new dynamo is urged.

A. B. Kerlin is an applicant at Verndale, Minn., for a franchise to establish an electric-light system.

The Twin City Electric company makes a proposition to the city of Grand Rapids, Wis., to put in a motor and pump water for the city, saving the expense of an engineer, a fireman and fuel.

Edward P. Burch, electrical engineer for the Twin City Rapid Transit company of Minneapolis and St. Paul, has resigned and will become a consulting engineer. He has been the company's chief electrician for eight years. R.

Canadian Intelligence.

Ottawa, Ont., December 23.—The Town Council of Greenwood, B. C., is considering two electric-lighting schemes. The proposal submitted by Mr. McIntosh, C. E., which includes a tramway to the town of Phœnix, seems to meet with popular favor by the ratepayers.

Messrs. McMannus, Lane & McMannus of Sydney, C. B., have installed for the Nova Scotia Steel and Iron company of Cape Breton a complete electric-lighting plant, consisting of one 75-kilowatt S. K. C. two-phase generator and a complete equipment of 60 alternating-current, enclosed arc lamps. This is said to be the first installation in Canada where an alternating-current generator has its capacity entirely taken up with arc lamps alone, and speaks well for the future of alternating-current arc lamps and also of the progress being made along these lines.

The island of Belle Isle, off the north coast of Labrador, has no communication with the mainland, and it is doubtful if telegraphic communication can ever be established with the island, unless by Marconi's system of wireless telegraphy, because icebergs are continually grounding in the Strait of Belle Isle, and no cable would survive a single season. It is no easy matter to build 800 miles of telegraph line along a mountainous, broken and barren shore, yet the Dominion government, fully aware of the desirability of connecting the strait by telegraph with the commercial system, is rapidly extending telegraphic communication along the north shore, and expects to reach the strait next year, when the wireless system will be tested and, if found feasible, adopted by the government.

Mr. Robert A. Ross of Montreal, who has just returned from China, Japan and British India, in the interests of a syndicate of capitalists, says that he comes back with the impression that outsiders can do nothing in Japan, in the way of electric-railway development, as the Japanese people are fully abreast of the times. They have sent their men abroad, have learned about all that could be taught them and have already established electrical schools, and have tramways in their largest cities.

The automobile has just made its first appearance on the streets of Montreal, and has created a favorable impression. If the intentions of the gentlemen controlling it are carried out, Montreal will see many of these vehicles upon its thoroughfares next summer. Messrs. A. J. Corriveau and H. M. Dandurand have secured the Canadian rights, and they are now engaged in selecting a suitable site in or near the city of Montreal for the erection of an automobile factory, and the work of manufacturing the automobile will be commenced at once. It is stated that the vehicle can be put on the market for $600.

The chemically pure sulphuric acid for use in the Ottawa Electric company's big storage battery has arrived from Liverpool, England, at Montreal, through the firm of Evans & Sons, wholesale druggists of the latter city. The acid, 5,000 pounds in quantity, is the largest amount of that article that has ever come to Canada in one shipment, it is said. When the order was cabled to the old country for such a large quantity of chemically pure sulphuric acid, the Liverpool druggists were simply staggered, and cabled back, asking if there was not some mistake, and if it was not common acid that was required. The Montreal firm returned a message that their original order was correct.

An important new departure is in contemplation by the Montreal Electric Street Railway company. It will be in the direction of providing for the convenience of smokers special cars by which they may travel and enjoy the luxury of the weed.

At a meeting of the Sarnia Street Railway company's stockholders of Sarnia, Ont., the question of converting the railway into an electric system was discussed, and a by-law authorizing the directors to raise $60,000 by debentures for the carrying out of the work was passed.

Application will be made at the ensuing session of Dominion Parliament for the incorporation of the Alaska and Northwestern Railway company, to construct and operate a steam or electric railway from Pyramid Harbor, on the Lynn Canal, through the Chilkat Pass, and thence by way of the Dalton Trail to Fort Selkirk, in the Canadian Yukon district. W.

PERSONAL.

In a recent issue of l'Elettricità of Milan, Italy, among a group of portraits of engineers is one easily recognizable as that of Mr. Bion J. Arnold, but the inscription beneath it is simply and familiarly "Bion Ing. I., Chicago."

Mr. F. F. Sapp, sales manager of the North Electric company of Cleveland, O., is spending the holidays with his friends and relatives in and near Chicago. Mr. Sapp is enjoying a needed rest, but when asked for his opinion of the business situation he said that he was sanguine that the telephone business of his company would be more than doubled during the forthcoming year.

Mr. T. C. Martin, editor of the Electrical World and Engineer of New York, is chairman of the committee of the American Institute of Electrical Engineers which is endeavoring to arrange a joint meeting with the British Institution of Electrical Engineers to be held in Paris in the week of August 12-18, 1900. It is desirable that members who may wish to attend such a meeting announce their intention as soon as possible.

ELECTRIC LIGHTING.

The New Albany Light, Heat and Power company of New Albany, Ind., has recently purchased from the Western Electric company a 200-kilowatt, two-phase Stanley generator, and is increasing the capacity of its plant.

ELECTRIC RAILWAYS.

Stockholders of the Chicago Consolidated Traction company have received circulars announcing the plan by which it is proposed to turn over the stock of the company to the Chicago Union Traction company.

The structure of the Northwestern elevated railway of Chicago was practically completed on Christmas Day. By January 1st the company confidently expects to have at least one train running over the entire road and connecting with the Union Loop.

From Dover, Del., comes word, under date of December 21st, that certificates of incorporation were filed there by the Doty Third Rail Electrical company of New York, "to transact, carry out, manufacture, sell and lease electrical appliances of all kinds." The incorporators are William W. Doty and William Reinhart of New York, William F. Wilson and Harry C. Frank, Mount Vernon, N. Y., and James Virden, Dover. The capital is $2,500,000.

A dispatch from Cincinnati, O., says the representatives of the American Railways company of Philadelphia, capitalized at $25,000,000, at the head of which is ex-President McLeod of the Philadelphia and Reading railway, are negotiating in that city for a controlling interest in the Cincinnati, Newport and Covington Railway company. The American Railways company has recently bought the bonds of a Dayton, O., company, has bought outright the Springfield railway and is said to have secured a $500,000 interest in the Chicago Union Traction company.

AUTOMOBILES.

An electric cab service is to be established in New Haven, Conn., by the New Haven Electric Cab company, capitalized at $60,000, and recently organized. Among the stockholders are S. W. Hart, Lucius W. Tuttle and F. B. Wells. The cabs will be run at regular intervals, and depot conections will be made.

Mayor Quincy of Boston has approved an order passed by the Board of Aldermen granting locations for an automobile merchandise and passenger-traffic line to the Boston Transit company, Henry B. Hyde president. The omnibus that has been considered seats 20 or 22 persons, four or six of them outside. The vehicles will probably be built in Hartford, Conn. Electricity will be their motive power, according to the statements of the promoters, though the Boston Transit company is authorized to use compressed air, gasoline or anything else. It is authorized also to carry freight and parcels, and even mails, though nothing has been done about providing facilities for any such business in the vehicles so far considered.

PUBLICATIONS.

The art of lithographer and printer is displayed to advantage on the handsome calendar for 1900 which the Kentucky Electrical company of Owensboro, Ky., is sending out with the compliments of the season.

A second edition of the lecture by Walter B. Snow, on "The Influence of Mechanical Draft Upon the Ultimate Efficiency of Steam Boilers," has just been issued by the B. F. Sturtevant company of Boston, Mass. Copies will be sent upon application.

In the December 23d issue of The Other Side in this self-explanatory announcement: "With the issue for January 6, 1900, the name of this publication will be changed to Public Policy, and the name of Mr. Allen Ripley Foote will be announced as its editor and manager."

Sipe & Sigler, Cleveland, O., have issued a neat catalogue devoted exclusively to the Willard automobile storage battery. The statement is made that the battery may be fully charged in 45 minutes—a fact which is regarded as an important advance in the new automobile industry. Various tables are given in the catalogue which indicate the amount of current necessary for different periods of charging. The manufacturers purpose to make a specialty of maintaining for a period of years at a specified sum all Willard automobile batteries in any make of carriage in which they may be used. Instructions for the care and maintenance of the battery are given in the catalogue, with a complete description of its construction and a statement of the method of operation.

A complete and well-arranged catalogue has been issued by Elmer G. Willyoung of New York city, successor to Elmer G. Willyoung & Co. of Philadelphia. The publication is devoted to electrical and scientific instruments and apparatus and it gives evidence of care and discrimination in its preparation. The various instruments are logically classified, and the description of each class is prefaced by general information which will be found especially useful in facilitating intelligent selection of apparatus on the part of many customers. Mr. Willyoung manufactures a full line of electrical instruments for laboratory and commercial work and also makes measuring apparatus for special purposes. Among the great variety of instruments illustrated and described in the catalogue are condensers, galvanometers, resistances, standard cells, testing sets, photometers, induction coils, wireless-telegraphy apparatus, voltmeters, ammeters, etc.

TECHNICAL SCHOOLS.

The Massachusetts Institute of Technology announces a recent gift of $50,000 from Mr. Augustus Lowell, which, according to the express wish of the donor, is to serve as the nucleus of a fund, the income of which shall be used for the benefit of the teaching staff of the Institute in cases of illness, death or retirement, subject to such regulations as the government may from time to time see fit to adopt. It is hoped that this gift will serve to attract attention to the need of still greater endowments of this character.

ELECTRICAL SECURITIES.

The General Electric company has declared a quarterly dividend of 1½ per cent., payable on January 15th to stock of record December 30th.

The Westinghouse Electric and Manufacturing company has declared a quarterly dividend of 1¾ per cent. on the preferred stock, payable January 2d. Books were closed December 23d and will be reopened January 3d.

MISCELLANEOUS.

A Milwaukee dispatch says that negotiations have been begun for the installation of the Johnson-Fortier system of wireless telegraphy in connection with the steamer lines plying daily and nightly between Chicago and Milwaukee. This installation will probably be made in the early part of the sum-

mer season, and land stations will be set up at Chicago, Kenosha, Waukegan, Racine and Milwaukee.

TRADE NEWS.

The Specialty Manufacturing company of Indianapolis, manufacturer of all kinds of fans, including electric fans, has just received an order direct from Moscow, Russia, for one dozen Triumph exhaust fans, in sizes assorted from 28 inches to 42 inches. The company says this order was placed after a thorough trial of its Triumph fan.

Announcement is made that the Garton-Daniels company of Keokuk, Ia., has been incorporated, to continue the business of the Garton-Daniels Electric company. The company announces that with increased capital and better facilities it will be better equipped than ever to handle the increasing demand for Garton lightning arresters. Other specialties will also be added to its line of manufacture.

BUSINESS.

One of the features of the new power plant of the Independent Electric Light and Power company of San Francisco is a complete mechanical-draft equipment, consisting of four fans arranged to operate upon the induced principle. These fans are arranged in pairs, each fan being 10 feet in diameter and provided with an independent eight by 12 inch horizontal engine, direct connected. This apparatus is furnished by the B. F. Sturtevant company of Boston, Mass.

Electra carbons, in a full line, are carried in stock by the Central Electric company, Chicago. These carbons have a high reputation for use in incandescent arc lamps.

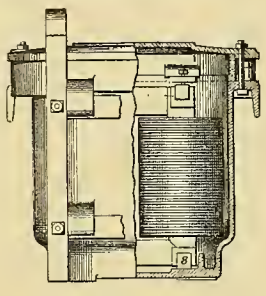
A 16-page bulletin has been issued by the Belden-Larwill Electric and Manufacturing company, Fort Wayne, Ind. It contains matter descriptive of the Belden 110 and 220-volt direct-current enclosed arc lamps. Several very clear illustrations of different parts of the lamp mechanism form a feature of the bulletin.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 19, 1899.

639,235. Conduit Plow. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 29, 1898.

Combined with an insulating support are positive and negative contact shoes insulated from each other, and mounted on opposite sides of the insulating support, forked metal supports to which the springs carrying the shoes are secured, a connection between the springs and their support, arranged so that the shoes make a trailing connection with the conduit conductors when traveling in a forward or backward direction, and a detachable securing device for holding the springs in place.



NO. 639,276.

639,252. Contact Shoe for Surface-contact Railways. Martin T. A. Kubierschky, Berlin, Germany. Application filed May 3, 1899.

The invention comprises angle-irons with a wearing strip between them, the angle-irons being displaced at points in the length of the shoe so as to form lozenge-shaped portions, some of which form different angles with the center line of the shoe from others.

639,276. Electric Transformer. James W. Packard, Warren, O. Application filed January 19, 1899.

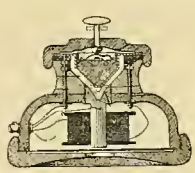
The side sections of the transformer are composed of groups of strips of equal length, the groups being arranged side by side and having square and inclined ends alternating, and the extreme ends of all the strips being arranged to register, whereby the sections are provided with solid ends adapted to be held in a chuck for winding. (See cut.)

639,291. Automatic Telephone. Elias E. Ries, New York, N. Y., assignor to the United States Automatic Telephone company of New York. Application filed August 7, 1897.

There is described a single portable apparatus embodying the signal-controlling device and circuit-changing and receiving mechanism of a telephone station, combined to successively perform their signaling, circuit-changing and receiving functions by the act of grasping and lifting the apparatus to the ear. (See cut.)

639,443. Electrically Driven Spindle. Henry B. Sawyer, Newton, and Russell Robb, Concord, Mass. Application filed June 28, 1899.

In the invention a series of spindles are driven by individual motors, and a single motor drives the feed rolls for all of the spindles. There are also provided a series of individual brakes for the spindles, a common controlling device and a brake for the feed-roll motor, all operating together by the movement of the common controlling device.



NO. 639,291.

639,447. Polyphase Alternating-current Magnet. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing company of New Jersey. Application filed June 11, 1898.

In combination with an automatic magnetic actuating device and an electromagnet for the control of its actuation consisting of a magnetic core having three or more legs are coils wound on the core between and separated from each other by the legs and adapted to carry alternating currents, the currents in adjacent coils being in different phase, and an armature adapted to co-operate with the legs.

639,450. Governor Mechanism. Reuben Shirreffs, Richmond, Va. Application filed June 20, 1899.

Electromagnetic means are provided in the mechanism for controlling the valves of a piston cylinder.

639,459. Electric Ground Detector for Constant-current Arc-light Circuits. John F. Stevens, Philadelphia, Pa. Application filed September 25, 1899.

The instrument comprises a fixed coil, a permanent magnet rotatable and pivoted therein, a pointer secured to the axis of the magnet, a resistance in series with the fixed coil, a switchboard containing three sockets, each electrically connected with a separate binding post, and two movable plugs adapted to fit the sockets, one plug being electrically connected with one end of the fixed coil and the other being electrically connected through the resistance with the other end of the fixed coil, as adjustable means for changing the connection between the instrument and the line and ground.

639,464. Coupling for Electric or Other Wires. Rolland Thompson, Newark, N. J., assignor of one-half to John Dunphy, New York, N. Y. Application filed October 11, 1899.

A coupling is described which is composed of a tubular shield open along one side and having a slot on the opposite side thereof, in combination with wires, having their ends horizontally split and the upper portions of the ends formed into hooks which engage with the slot, and the lower portions abutting so as to form a flush surface on the under side of the wires.

639,505. Electrical Transformer. Arthur F. Berry, Market-Harborough, England. Application filed June 16, 1897.

The transformer comprises primary and secondary coils, an iron core composed of a number of comparatively thin iron plates having holes therethrough of uniform width and each built up of a number of pieces of thin sheet-iron having their adjacent ends arranged to form butt and lap joints alternately, the plates being arranged to surround the coils and leave a longitudinal air passage through the core and spaced apart so as to leave between adjacent plates longitudinal air passages surrounding the coils, and layers of insulating material inserted between the coils and between the coils and the adjacent edges of the plates.

639,526. Apparatus for Telephonic Systems. Frank B. Cook, Chicago, Ill. Application filed November 30, 1894.

The apparatus consists of a normally open telephone circuit, a calling generator included therein, a generator shunt operated automatically by the driving mechanism for the generator, a telephone set in the telephone circuit and in series with the generator and the line, and a telephone switch controlling the telephone circuit by closing and opening the same to establish and disestablish the line circuit relatively to the generator and the telephone set, whereby the telephone must be removed from its support in order to ring together with a signaling indicator in a branch circuit. (See cut.)

639,527. Drop-restoring Device for Telephone Switchboards. Frank B. Cook, Chicago, Ill. Original application filed November 30, 1894. Divided and this application filed November 20, 1896.

The device consists of a plurality of separable lifting members, one member assembled upon each annunciator drop, whereby when the drops are positioned upon the switchboard frame the lifting members are connected in a manner to form a continuous lifting member for each vertical row of drops upon the board, and means for operating the continuous lifting member from one point to restore all the fallen drops of the vertical row simultaneously.

639,528. Telephone Transfer Board. Frank B. Cook, Chicago, Ill. Application filed December 22, 1896.

A switchboard, a spring jack and a plug opening therein are combined with a magnet or magnets in proximity to the opening and a shutter armature normally away from the opening directly attracted by the magnet to close the jack opening.

639,557. Electrical Snap Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing company, Hartford, Conn. Application filed October 28, 1898.

The switch consists of a rectilinearly movable plate having spring and locking lugs, an oscillating circuit opener and closer with spring and locking lugs, the respective locking lugs being so arranged that the locking lug on the plate remains in the path of a locking lug on the circuit opener and closer during the first part of its travel when the plate is moved, an actuating spring with an end extending each side at the spring projections on both the plate and the circuit opener and closer, and means whereby the plate may be moved.

639,590. Electric Transformer. Arthur H. Loring, Minneapolis, and Harry L. Clark, St. Paul, Minn. Application filed June 24, 1899.

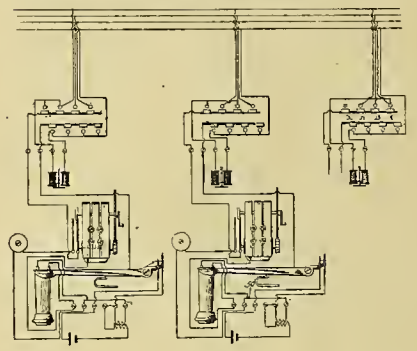
In the transformer are combined with the coils of a laminated core piece made in separate solid sections, a casing, a supporting device secured thereto to hold the main section of the core, a bracket attached to the supporting device to hold the smaller section of the core and means to bind the sections firmly together to form a closure of the magnetic circuit.

639,652. Secondary Battery. Oskar Behrend, Frankfort-on-the-Main, Germany. Application filed October 30, 1899.

An electric accumulator is described the electrodes of which are separated one from another by a plate or sheet of "luffah" which previously has been subjected to pressure, the remaining spaces between the plates or the plates and the receptacle being filled with powdered glass.

639,688. Circuit Breaker or Line Opener. Frederick C. Robertson, Toronto, Canada. Application filed June 25, 1898.

In the invention are two parallel heat-expansive bars or tubes having one each of their adjacent ends rigidly connected by a yoke piece, one of the bars or tubes having spirally wound on its surface a section of conductor and provided at its free end with a contact point, the other bar or tube secured (at its end distant from yoke piece) to a standard carrying a contact point facing contact point carried on bar, the contact points being normally open and closing when the bar on which the conductor is wound is expanded in advance of the other bar by heat generated by action of the current in the conductor.



NO 639,526.

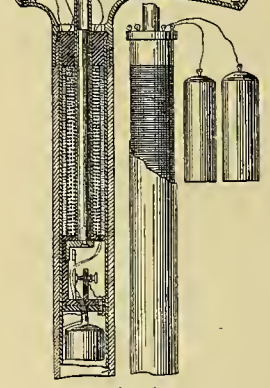
639,690. Electric Cane. Walter N. Sherman, Merced, Cal. Application filed February 4, 1899.

The cane combines with a hollow body, a hollow handle screwed on the top of the body, an induction apparatus and a dry cell in the body, the shield of the apparatus extending out from the body through the handle to the outside thereof and adapted to be drawn therefrom to vary the induction, removable caps for the ends of the handle, an insulating plate in one end of the handle having contacts connected with the induction apparatus, and metallic electrodes and attachments for the induction apparatus in the other end of the handle. (See cut.)

DESIGNS.

32,003. Incandescent Lamp Socket. Rudolph Meyer, New York, N. Y. Application filed October 30, 1899. Term of patent, seven years.

32,004. Electric-armature Mounting. James H. Mason, New York, N. Y. Application filed November 7, 1899. Term of patent, seven years.



NO. 639,690.

32,019. Rail Bond. Charles J. Mayer, Philadelphia, Pa. Application filed November 15, 1899. Term of patent, 14 years.

32,020. Rail Bond. Charles J. Mayer, Philadelphia, Pa. Application filed November 18, 1899. Term of patent, 14 years.

32,021. Rail Bond. Charles J. Mayer, Philadelphia, Pa. Application filed November 16, 1899. Term of patent, 14 years.

32,022. Rail Bond. Charles J. Mayer, Philadelphia, Pa. Application filed November 16, 1899. Term of patent, 14 years.

Western Electrician.

$3 per Annum. Copyright, 1899, by Electrician Publishing Company, Chicago. EVERY SATURDAY. Entered at Chicago Postoffice as mail matter of the second class. 10 cents per Copy.

Vol. XXV. CHICAGO, JULY 1, 1899. No. 1

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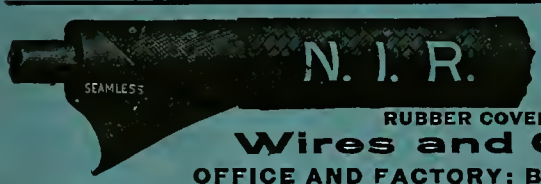
FOR MOTORS, ELECTRICAL APPARATUS, TELEPHONES, SWITCHBOARDS, DYNAMOS ETC.
Write for Estimates
BECKER NAME PLATE COMPANY
34 Oliver St. Boston, Mass.

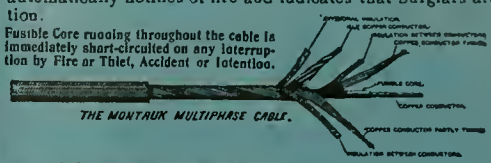


National India Rubber Co's
RUBBER COVERED
Wires and Cables.
OFFICE AND FACTORY: BRISTOL, R. I.

Automatic Switchboard.
Help yourself from your own 'phone to anything you like.
FULLY GUARANTEED.
National Automatic Telephone Co.,
71-75 W. Jackson Blvd., CHICAGO.

WESTON Electrical Instrument Co.,
114-120 William St., NEWARK, N. J., U. S. A.
Weston Standard Portable Direct Reading
Voltmeters, Millivoltmeters, Voltammeters, Ammeters, Milliammeters,
Ground Detectors and Circuit Testers,
Ohmmeters, Portable Galvanometers.

Our Portable Instruments are recognized as The Standard the world over. The Semi-Portable Laboratory Standards are still better.
Our Station Voltmeters and Ammeters are unsurpassed in point of extreme accuracy and lowest consumption of energy.

The Only Fire Detective Cable in the World.
Every Fractional Part of which is contiouously Thermostatic, and designed for all Interior Electric Wiring Adaptations. It lights the gas! Rings the door bells! It automatically notifies of fire and indicates that burglars are at work, all in one installation.
Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, Accident or Intention.

THE MONTAUK MULTIPHASE CABLE.
Why use dormant wires? The Montauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human being is to the touch of flame.
Write for descriptive matter. Call and see cables operated.
MONTAUK MULTIPHASE CABLE CO.,
Telephone 4031 Cortlandt. 100 Broadway, NEW YORK.

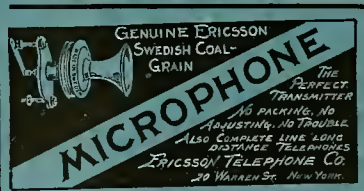
2,000 IN USE.
Bipolar and Multipolar Motors from ⅛ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

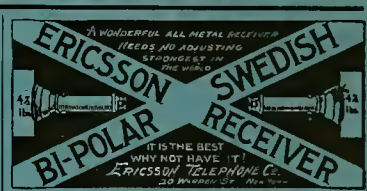
Queen & Co.,
1012 Chestnut St., PHILADELPHIA.
Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils

INSULATE ARMATURES WITH PAINT OR VARNISH ACCORDING TO CHEMICAL LAW INSTEAD OF BY HABIT. NOWHERE ARE EXPERIMENTS OR ARCHAIC METHODS SO WASTEFUL
MASSACHUSETTS CHEMICAL CO. U.S.A.

Chicago Belting Company
MAKERS OF LEATHER BELTING — RELIANCE — DEALERS IN MILL SUPPLIES
DYNAMO BELTING.
The production of our Dynamo braod of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and to all climates.
When ordering Dynamo Belting always state the system used.
OFFICE AND FACTORY 67-69 SOUTH CANAL STREET CHICAGO, ILL.
NEW ORLEANS. ST. LOUIS MEMPHIS

KESTER'S SELF FLUXING SOLDER
Kester Electric Mfg. Co.
Manufacturers of the Wire Cloth Dynamo and Motor Brushes. Solders and Soldering Fluxes of all kinds.
No. 249-51 So. Jefferson St., CHICAGO, ILL.





THE BEST—THE "NEW STYLE"
Receptacle and Attachment Plug.
The latest in this line is the "NEW STYLE" made by
WM. T. PRINGLE, 1026 Filbert Street, PHILADELPHIA.
Western Representatives: J. B. McKeague Co., 324 Dearborn St., Chicago.

Your T.-H. arc lamps ARE NOT COMPLETE unless they are equipped with the
Knutson Gravity Clutch,
Acknowledged by the leading electric light plants to be
THE CLUTCH.
Send for a sample and put it in "that lamp over there" that has been giving you so much trouble, and let us prove to you that this is no fake. There are thousands already in use. Of course you think the various kinds of clutches you are now using are allright, but just wait till you have tried ours: that is all we want you to do. They are the CHEAPEST and the BEST.
A. W. KNUTSON & CO., Galesburg, Ill.

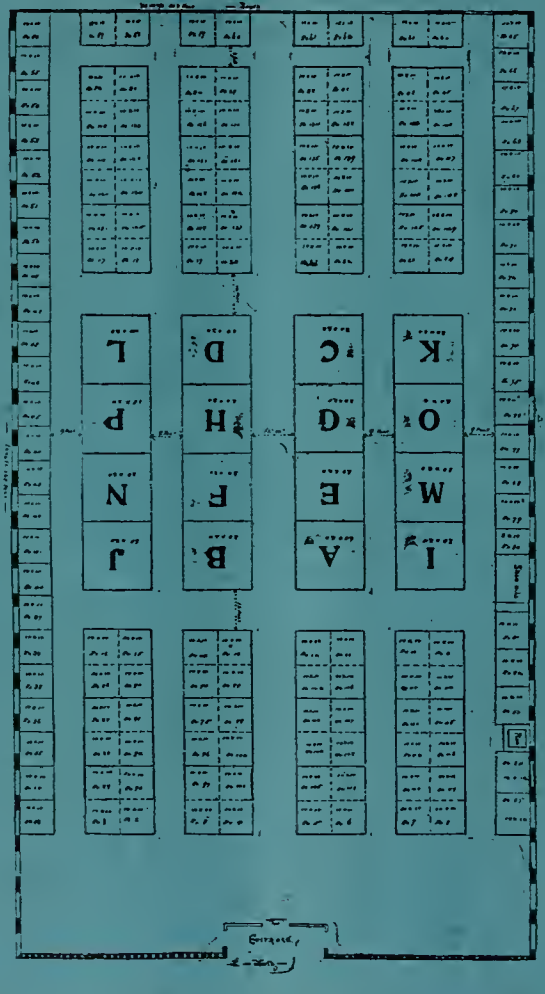
TO BE A

PALACE OF ELECTRICITY

Space Going Fast—Don't Wait Until the Last Moment Before Coming In.

IF YOU HAVE NOT RECEIVED A PROSPECTUS, SEND US A POSTAL.

THIS WILL GIVE YOU AN IDEA OF THE LOCATION OF BOOTHS.



From September 25, to October 9, 1899.

Don't Study Over This Matter Any Longer.

You Will Be Perfectly Safe in Exhibiting.

It Is a Sure Winner.

TO BE HELD IN THE TATTERSALL'S BUILDING.

(DIMENSIONS, 148 X 265 FEET.)

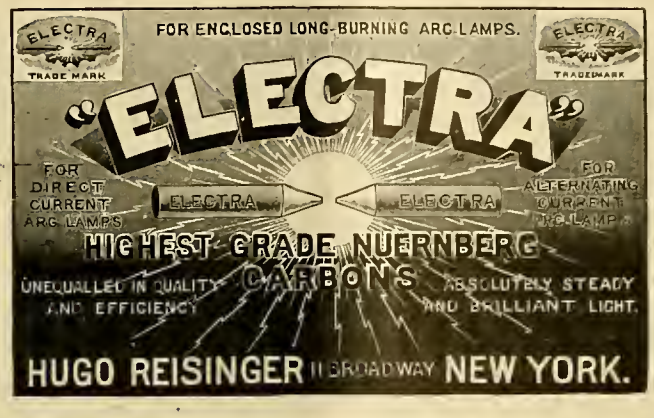
NATIONAL EXPOSITION OF ELECTRICAL ARTS CO.

INCORPORATED UNDER THE LAWS OF ILLINOIS. CAPITAL, $50,000.

W. E. BURNHAM, Mgr., 410 New York Life Building, Chicago, Ill.

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."



Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

No. 357 Dearborn Street CHICAGO, ILL.

SEND FOR OUR NEW CATALOGUE AND HAND BOOK OF INFORMATION. SENT FREE.

We Manufacture. No Middle Man's Profit.

Orders From Supply Houses Solicited.

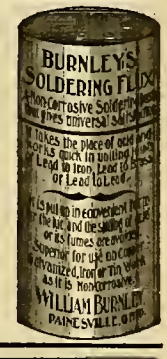
Wholesale and Retail TELEPHONE SUPPLY HOUSE.

Burnley Dry Battery.

This is the Pioneer Dry Battery, 1888-1899. Perfected by long experience to absolute reliability. Regular size 6x 2½ inches. Special sizes 4x2, 4x1⅝ and 2x1½ inches. Regular size, 1.5 volts and 6 to 8 amperes. Endorsed by the leading telephone companies and supply houses. Testimonials and endorsements furnished on application to

The Burnley Soldering Paste.

Every construction man should use this Paste. Last year we sold 200,000 ¼-pound boxes. It contains no acids, is non-corrosive and insulating in its nature. We put it up in ¼, ½, 1, 5 and 10 pound packages. The patent claims covering this paste are broad and we will prosecute to the full extent of the law all infringers of our rights.



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PAINESVILLE, OHIO.

CHICAGO INSULATED WIRE CO.

152-154 Lake St.
CHICAGO, ILL. U.S.A.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

"HARDY" INCANDESCENT LAMPS.

HARDY LAMP COMPANY, PITTSFIELD, MASS.

TROTTER'S COMMUTATOR COMPOUND.
GOLDMARK & WALLACE.
121 WORTH ST. NEW YORK.
AGENTS FOR "KOCH" WOVEN WIRE DYNAMO BRUSHES.

All Careful Engineers use MONA COMMUTATOR COMPOUND, A perfect lubricator and spark preventer. Prepared only by
TROTTER'S MONA MANUFACTURING CO., Limited,
65 West Broadway New York City.

SMALL SPRINGS

OF EVERY DESCRIPTION
THE WALLACE BARNES CO.,
ESTABLISHED 1857 BRISTOL, CONN., U. S. A.

KNAPP FAN MOTOR OUTFITS WITH GORDON PRIMARY CELLS

The hot spell of summer is approaching and to those who wish to seek comfort at home or in the office, professional or mercantile, we desire to call attention to these celebrated outfits.

We guarantee the highest speed at the lowest cost for primary cells.

These fan motor outfits are manufactured in two sizes, as follows:

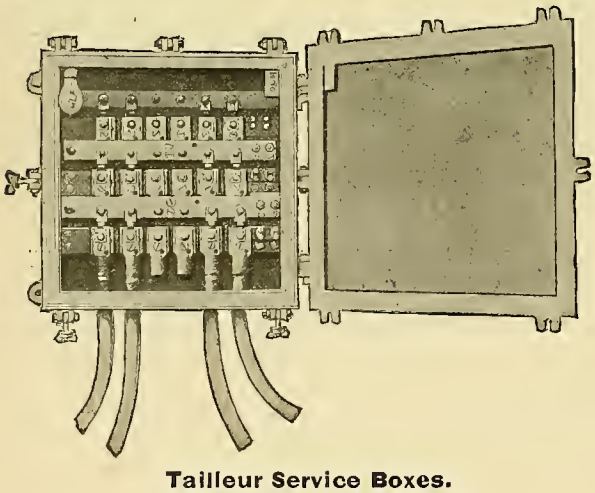
Type C, 8-inch Fan, with 3 No 1A Gordon Cells.
Type E, 10-inch Fan, with 4 No. 1A Gordon Cells.

These outfits will give a life of over 150 hours without recharging, at a speed of at least 750 revolutions per minute.

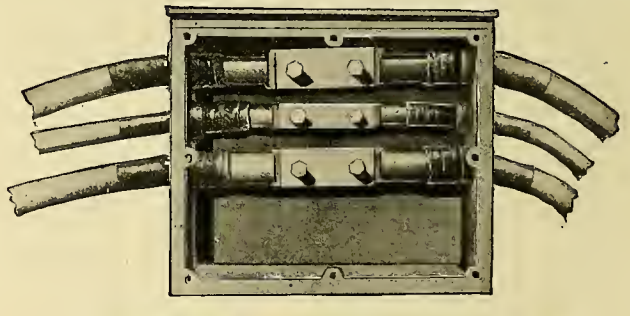
For full particulars, price list, etc., address

GORDON BATTERY COMPANY,
594 Broadway, New York.
Western Representative, GEORGE W. PATTERSON, 1533 Marquette Bldg., Chicago, Ill.

G. I.
UNDERGROUND MATERIAL.



Tailleur Service Boxes.
Tailleur Coupling Boxes.



Tailleur High-Tension Coupling Joints.
Tailleur Junction Boxes.

PARAGON FANS AND WRIGHT METERS.

General Incandescent Arc Light Co.,

572-578 First Ave., Cor. 33d St., NEW YORK.

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BOSTON, 31 Milk Street.
PHILADELPHIA, 233 Drexel Building.
CLEVELAND, 39-47 E. Prospect Street.
SAN FRANCISCO, 598 Parrott Bldg.

MARTIN J. INSULL CO.:

CHICAGO, 1012-13 Monadnock Block.
ST. LOUIS, 511 Security Building.
MINNEAPOLIS, 616 Guaranty Building.
MILWAUKEE, 700 Pabst Building.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

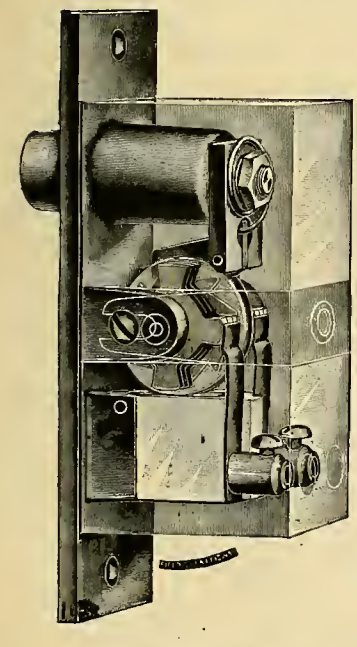
HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

THE ECO DOOR SWITCH

Makes Contact Every Other Time.



Approved by National Board of Fire Underwriters.

When the Door is Shut—
NO LIGHT!

Open It to Go In—
LIGHT!

Shut It After You Are In—
STILL LIGHT!

Open It To Go Out—
NO LIGHT!

Shut It After You Are Out—
STILL NO LIGHT!

Size over all, 3¾ inches long, 1 inch wide, 1⅝ inches deep.

EDWARDS & CO.,

A. LÜNGEN. NEW YORK, N. Y., U. S. A.

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Telephones,
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Eccentric Clamps,
Pay-out Reels,
Hand Generators,
Okonite Wires,
Nungesser "Drys,"
Extension Bells,

CENTRAL ELECTRIC COMPANY · CHICAGO · OKONITE IT NEVER DISAPPOINTS

Soldering Compounds,
Upright Brackets,
Pole Counters,
Pole Steps,
Lead Cable,
Induction Coils,
Expansion Bits,
Sneak Fuses,

IN ALL THE COMPREHENSIVE NEEDS OF MODERN PRACTICE.

Branch: SOUTHERN ELECTRICAL SUPPLY CO., St. Louis.

A BELT FULL OF CLING-SURFACE

Will neither slip, run off, nor need taking up, and its transmitting capacity is only limited by the strength of the belt.

CLING-SURFACE MFG. CO., 177-182 Virginia St., Buffalo, N. Y.

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Morris Arc Lamp Co.
Western Electric Co.
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Chicago Belting Co.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.

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Chicago Belting Co.
Leather Preserver Mfg. Corp.
Peerless Rubber Mfg. Co.
Smith Belting Co.

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Electrician Publishing Co.

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Central Electric Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Kester Electric Mfg. Co.
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Central Electric Co.
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Electric Appliance Co.
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Central Electric Co.
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Eastern Electric Cable Co.
General Electric Co.
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New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Chicago Edison Co.
Electric Appliance Co.
Gen'l Inc. Arc Lt Co.
National Carbon Co.
Reisiger, Hugo.
Western Elect. Supply Co.

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Harvey Co., The G. F.

Cigar Lighters.
Stanley & Patterson.

Clutches (Arc Lamp).
Knutson & Co., A. W.

Coils.
Varley Duplex Magnet Co.

Compound.
Dearborn Drug & Chem. Wks
Illinois Electric Co.
Mass. Chemical Co.
McLennan & Co., K.
Metropolitan Steam Boiler Compound Mfg. Co.
Standard Paint Co.
Trotter's Mona Mfg Co., Ld.
Western Electric Co.
Western Elect. Supply Co.

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Central Electric Co.
Electric Appliance Co.
Western Elect. Supply Co.

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Chicago Edison Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
Hays Construction Co.
Hodge-Walsh Elec. Eng. Co.
Sturtevant Co., B. F.
Victor Electric Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Bryan & Humphrey.
Central Electric Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
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Hays Construction Co.
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Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
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Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
American Elec. Fuse Co.
Bossert Elec. Const. Co.
Bryant Electric Company.
Central Electric Co.
Chicago Edison Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
Gates & Randolph.
General Elec. Co.
General Inc. Arc Light Co.
Hart & Hegeman Mfg. Co.
Illinois Electric Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Dynamos.
Central Electric Co.
Chicago Rheostat Co.
Diehl Mfg. Co.
Eagle Electric Works.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
Gates & Randolph.
General Electric Co.
General Inc. Arc Light Co.
Bobart Elec. Mfg. Co.
Matthews, W. N.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Elec. Heat'g Appliances.
American Elec. Heater Co.

Electric Railways.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electric Vehicles.
American El. Vehicle Co.
Fischer Equipment Co.

Electrical and Mechanical Engineers.
Bain, Force.
Bryan & Bumphrey.
Bays Construction Co.
Hodge-Walsh Elec. Eng. Co.
Sargent & Lundy.

Electrical Instruments.
American El. Specialty Co.
Bryant Electric Company.
Central Electric Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
Gates & Randolph.
General Electric Co.
General Inc. Arc Light Co.
Illinois Electric Co.
Paiste Co., H. T.
Queen & Co.
S. E. I. Co.
Victor Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electrical Specialties.
American El. Specialty Co.
Bryant Electric Company.
Central Electric Co.
Edwards & Co.
General Inc. Arc Light Co.
Pringle, Wm. T.
Therien Tool Works.
Victor Electric Co.
Western Elect. Supply Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.

Employment Agency.
Technical Agency.

Engines, Steam.
Ball Engine Co.
Sturtevant Co., B. F.

Fan Outfits.
Central Electric Co.
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
General Inc. Arc Light Co.
Gordon Battery Company.
Illinois Electric Co.
Marietta Mfg. Co.
Paragon Fan Motor Co.
Riemann & Co., A.
Specialty Mfg. Co.
Sturtevant Co., B. F.
Victor Electric Co
Wagner Electric Mfg. Co.
Warren El. & Specialty Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Delaware Hard Fibre Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fixtures, El. & Comb'n.
Central Electric Co.
Western Elect. Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mf. Co.
Electric Appliance Co.
Western Elect. Supply Co.

Gaskets.
Peerless Rubber Mfg. Co.

Gas Lighting, Electric.
Advance Specialty Co.
Central Electric Co.
Western Electric Co.

Gears.
Besly & Co., Chas H.

General Elec. Supplies.
Austin & Co., M. B.
Central Electric Co.
Chicago Edison Co.
Edwards & Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
Manhattan Elec. Sup. Co.
Peru Elec. Mfg. Co.
Stanley & Patterson.
Victor Electric Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Central Electric Co.
Phoenix Glass Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Insulators and Insulating Materials.
Bryant Electric Company.
Central Electric Co.
Chicago Edison Co.
Chicago Insulated Wire Co.
Delaware Hard Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Inc. Arc Light Co.
Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Austin & Co., M. B.
Central Electric Co.
Chicago Insulated Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Leschen-Macomber-Whyte Co.
Montauk Multiph. Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elec. Const. Co.
General Inc Arc Light Co.

Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Electric Appliance Co.
Fort Wayne Lamp Co.
General Electric Co.
General Inc. Arc Light Co.
Hardy Lamp Co.
Illinois Electric Co.
Lynn Inc. Lamp Co.
Manhattan Elec. Sup. Co.
Renew Lamp Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
United Elec. Imp. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
American Elec. Fuse Co.
Central Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
Garton-Daniels Elec. Co.
General Electric Co.
Harvard Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Manipulators (Inc. Lmp).
Inc. El. Lt. Manipulator Co.

Mechanical Machinery.
Besly & Co., Chas. H.
Stillwell-Bierce Smith-Vaile.

Meters.
Wright Discount Meter Co.

Mica.
Central Electric Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
General Electric Co.
Westinghouse El. & Mfg. Co.

Motors.
Chicago Rheostat Co.
Diehl Mfg. Co.
Eagle Electric Works.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
Gates & Randolph.
General Electric Co.
General Inc. Arc Light Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Matthews, W. N.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Victor Electric Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Name Plates.
Becker Name Plate Co.

Packing.
Besly & Co. Chas. H.
Peerless Rubber Mfg. Co.

Paints.
Central Electric Co.
Cling-Surface Mfg. Co.
Mass. Chemical Co.
Standard Paint Co.

Patent Attorney.
Johnston, Thomas J.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.
Goldsmith Bros.

Poles.
Berthold & Jennings.
Brown, M. R., & Co.
Central Mfg. Co.
Lindsley Bros. Co.
Perrizo & Sons.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
Central Electric Co.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
Aaron Electric Co.
Chicago Edison Co.
Hodge-Walsh Elec. Eng. Co.
Stewart Electrical Co.

Rheostats.
Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Ind. Arc Lt Co.
Iron Clad Resistance Co.
Victor Electric Co.
Westinghouse El. & Mfg. Co.

Second-Hand Machin'y.
Aaron Electric Co.
Chesley Machinery Co.
Hodge-Walsh Elec. Eng. Co.
Matthews, W. N.
Rossiter, MacGovern & Co.
Stewart Electrical Co.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.

Speaking Tubes.
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Illinois Electric Co.
Paquette & Co., H. A.
Western Electric Co.
Western Elect. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Weston Electrical Inst. Co.

Springs.
Barnes Co., The Wallace.
Cary Spring Works.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.

Tapes, Insulating.
American Electrical Works.
Central Electric Co.
Electric Appliance Co.
Illinois Electric Co.
Leschen-Macomber-Whyte Co.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
Allen-Hussy Co.
American Elec. Fuse Co.
American El. Telephone Co.
Bissell & Co., F.
Central Tel. & Elec. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Holyoke & Holyoke.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Manhattan Elec. Sup. Co.
Manus Electric Co.
Moon Mfg. Co.
National Auto. Teleph. Co.
Noblett, E. J.
North Electric Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tl. M. Co.
Transmitter Mfg. Co.
Victor Telephone Mfg. Co.
Warner Co. Wm. F.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Cons. Co.
Williams-Abbott Elec. Co.
Williams Electric Co.

Tools.
Klein & Son, Mathias.
Therien Tool Works.

Transformers.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Kuhlman Electric Co.
Matthews, W. N.
Siemens & Halske Electric Co. of America.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Stillwell-Bierce Smith-Vaile

Universities.
Worcester Polytechnic Inst.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire, Bare.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Illinois Electric Co.
Leschen-Macomber-Whyte Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Elect. Supply Co.

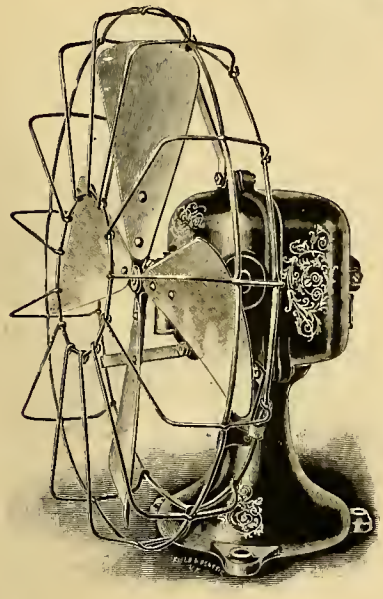
Woodwork, Electrical.
Amer. Bardwood Mfg. Co.
Noblett, E. J.

X Ray Outfits.
Central Electric Co.
Queen & Co.
Victor Electric Co.

For Alphabetical Index of Advertisements See Page III.

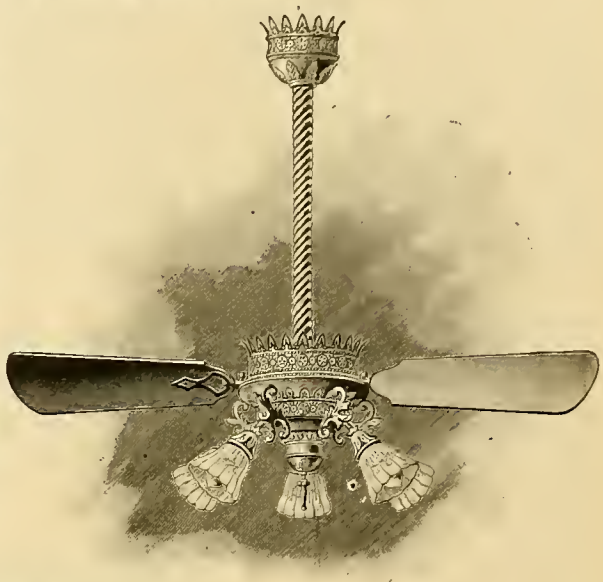
DIEHL ELECTRIC FANS,

FOR ALL CIRCUITS, EXCEPT ALTERNATING.



Our line of Electric Fans for ALL purposes for the present season is the most complete that we have ever placed in the market, and the high standard of our product has been strictly upheld.

Our fans are the cheapest because they are absolutely the best made: wear longest, require less outlay for repairs and show a higher efficiency than any other fan. This statement is fully sustained by the past record of our fans. Our place has always been in the lead and we intend to maintain that position.



SEND FOR CATALOGUE.

DIEHL MANUFACTURING CO.

SHOW ROOMS { 561-563 Broadway, NEW YORK. 192-194 Van Buren St., CHICAGO. 128-132 Essex St., BOSTON.

MAIN OFFICE AND WORKS:

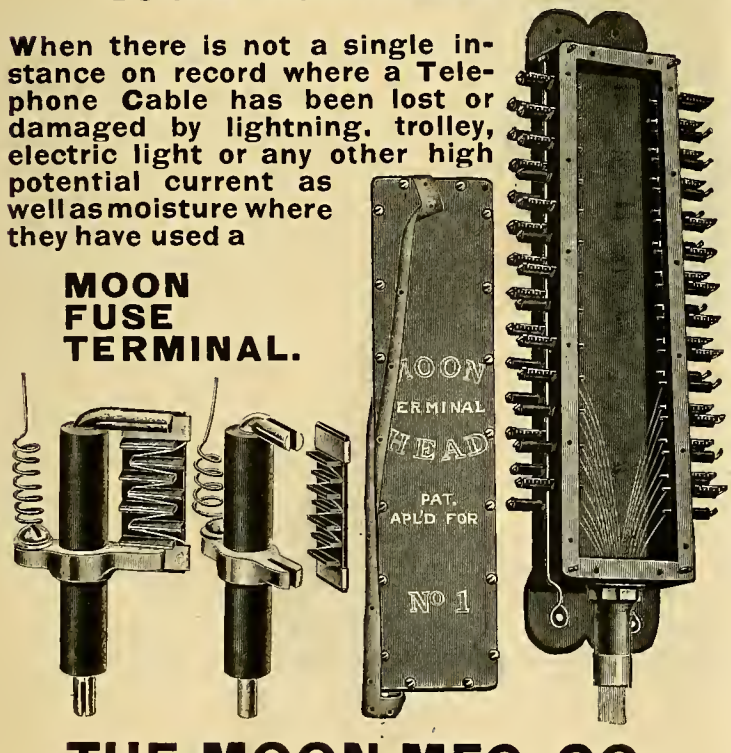
ELIZABETHPORT, N. J.

COLD FACTS.

DO THEY NOT INTEREST YOU ?

When there is not a single instance on record where a Telephone Cable has been lost or damaged by lightning, trolley, electric light or any other high potential current as well as moisture where they have used a

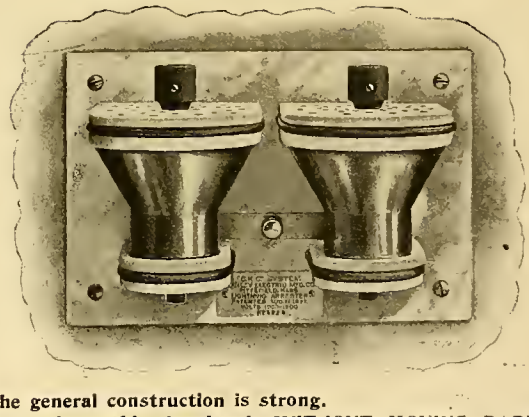
MOON FUSE TERMINAL.



THE MOON MFG. CO.,

43 to 49 S. CANAL STREET, CHICAGO.

THE S. K. C. ALTERNATING-CURRENT LIGHTNING ARRESTER.



The general construction is strong.

It is thoroughly insulated, WITHOUT MOVING PARTS, and WITHOUT COILS or LARGE SERIES RESISTANCES to impede the lightning discharge to the ground.

OUTDOOR and INDOOR double-pole types.

Write for "Bulletin No. 104," fully describing these arresters, and dealing with the general subject of lightning protection for lines and apparatus.

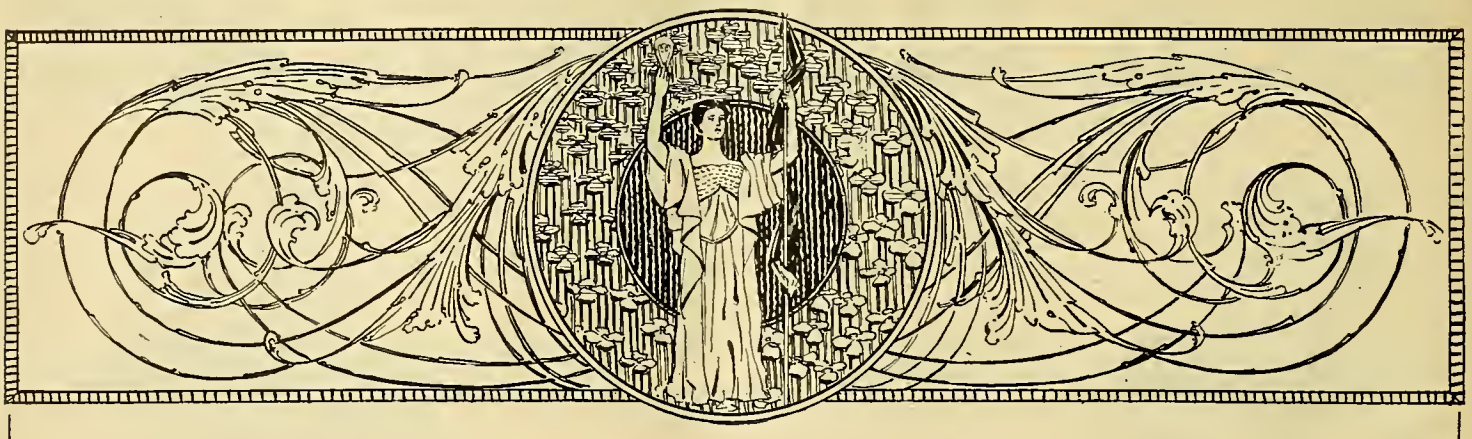
WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

MANUFACTURERS AND DEALERS.

Electric Light and Power Apparatus,
Arc and Incandescent Lamps, Wire, Cable,
Telegraph Station and Measuring Instruments,
Electric Light and General Supplies.

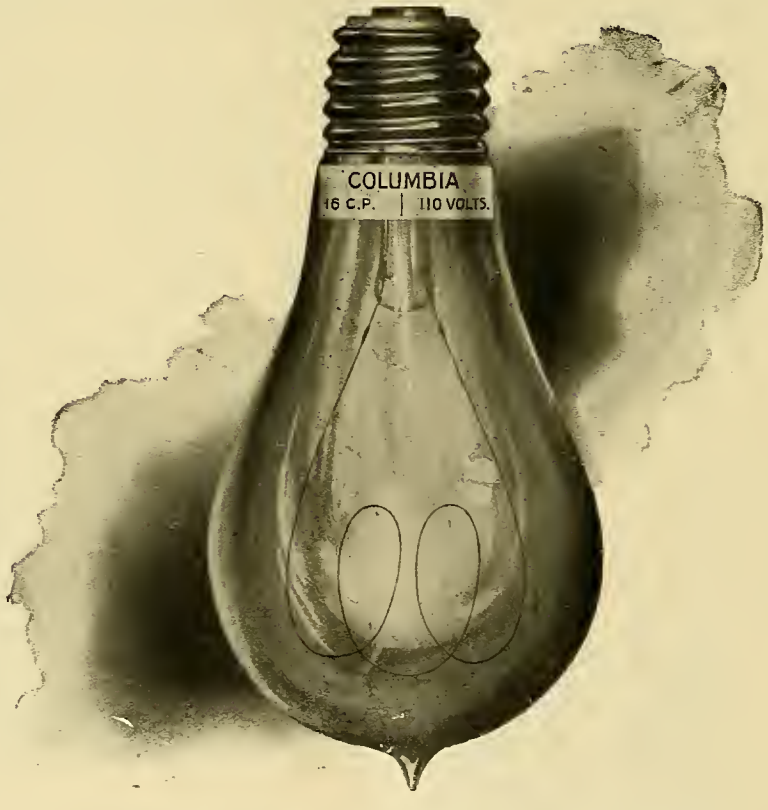
LONDON, 79 Coleman Street, E. C., and North Woolwich, E.
ANTWERP, 33 Rue Boudewyns.
PARIS, 46 Avenue de Breteuil.



COLUMBIA LAMPS

UNEQUALED IN QUALITY.

The test of time is what demonstrates the value of a lamp. The **Columbia** has been on the market for 10 years, during which time it has proved all we claimed for it—and more. Unsurpassed facilities, best skill and workmanship have enabled us to make the **Columbia** the best incandescent lamp on the market.



We could enumerate the superior qualities of **Columbia** lamps from now until doomsday, but this, we know, is not as satisfactory to the buyer as a disinterested demonstration; this you can make by sending a trial order. It will easily convince you of the advisability of placing your annual contract with us.

A FEW OF ITS STRONG POINTS:

Uniform Voltage.
Uniform Efficiency.
Highest Maintenance of Candle Power.
World-wide Reputation for Excellence.
Uniform Candle Power.
Uniform Current Consumption.

The Columbia Incandescent Lamp Co.,

MAIN OFFICE AND FACTORY:

1910-1912-1914 Olive St., ST. LOUIS, MO.

BRANCH OFFICES:

Lamps in Stock. { NEW YORK, 1311 Havemeyer Building.
CHICAGO, Central Electric Co.
SAN FRANCISCO, Paul Seller Electrical Works.

WHY

We progress is because we cater to the wants of our customers.

YOU

Cannot afford to buy elsewhere without first investigating our claims.

SHOULD

You happen to be in the market for supplies get our prices.

READ

Our advertisements and descriptive matter and consult our catalogues for information on the latest and most modern electrical improvements.

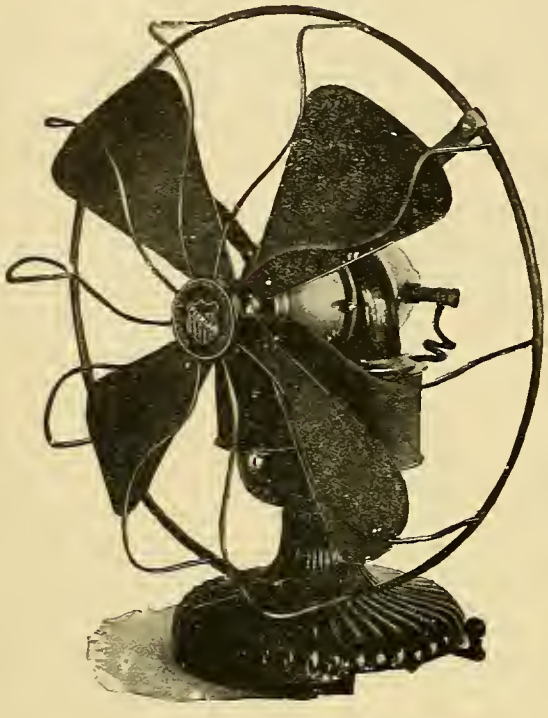
THIS

Is the proper season to make your purchases to advantage.

WESTERN ELECTRICAL SUPPLY CO.,

10 AND 12 NORTH 9TH STREET, ST. LOUIS, MO.

Peerless Fan Motor.



The Handsomest and Most Efficient on the Market.

12-inch fan consumes only **35 WATTS** running 1,850 revolutions per minute. PRICE RIGHT.

Immediate delivery from stock in all large cities.

W. S. HULL, Agent,
144 FRANKLIN STREET, CHICAGO.

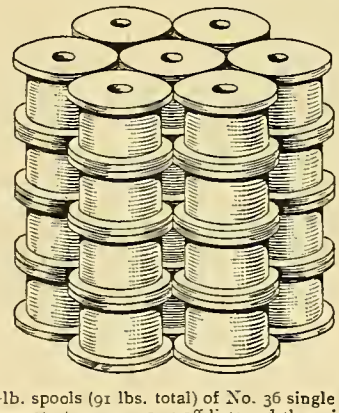
THE WARREN ELECTRIC AND SPECIALTY CO.,

MFRS. PEERLESS { Incandescent Lamps, D. C. Desk Fan Motors, Transformers.

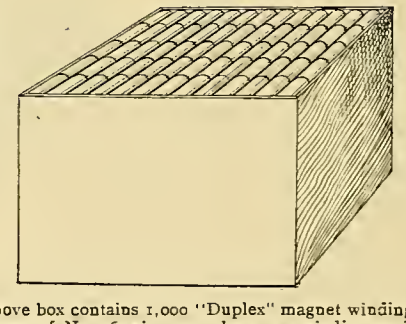
WARREN, OHIO.

Telephone Men and All Users of MAGNET COILS—

Have Your MAGNET COILS Wound BY MACHINERY.



HERE'S THE OBJECT LESSON— A PLAIN FACT.



These 28 3-lb. spools (91 lbs. total) of No. 36 single silk-covered wire will cost you $243 net at 50, 10, 10, 5 off list; and there is sufficient wire on these 28 spools to wind 1,000 500-ohm bridging-bell magnets. Your winding labor will cost you at least $5 additional, making a total cost of your own 1,000 magnets finished at factory, $248.

The above box contains 1,000 "Duplex" magnet windings. Each winding is made up of No. 36 wire, 500 ohms per winding, and each winding has 12 per cent. more turns than there are in the ordinary wound magnet. Price, $218 70 net This is 10 per cent. less than your wire bill ***and we charge nothing for winding.***

THE VARLEY DUPLEX MAGNET CO.,

138 7TH ST., JERSEY CITY, N. J.,

DOES IT BY MACHINERY.

We can Save You CONSIDERABLE Money.

FORT WAYNE ELECTRIC WORKS

(INCORPORATED).

"Wood" Arc Circuit Cut-Outs

ARE MADE FOR HEAVY SERVICE.

You Can Always Rely on Them. They are Incombustible and Never Wear Out.

WE ARE MAKING MORE FORT WAYNE DUNCAN METERS THAN EVER BEFORE.

OFFICE AND FACTORY: **FORT WAYNE, INDIANA.**

BOILER DOCTORS! "CONSULTATION FREE."

WE ANALYZE FEED WATER AND PRESCRIBE REMEDY--NO "CURE ALL" OR QUACKERY.

MAILED FREE: A valuable morocco leather covered Note Book to any engineer sending us the H. P. of his plant, with his home and business address.

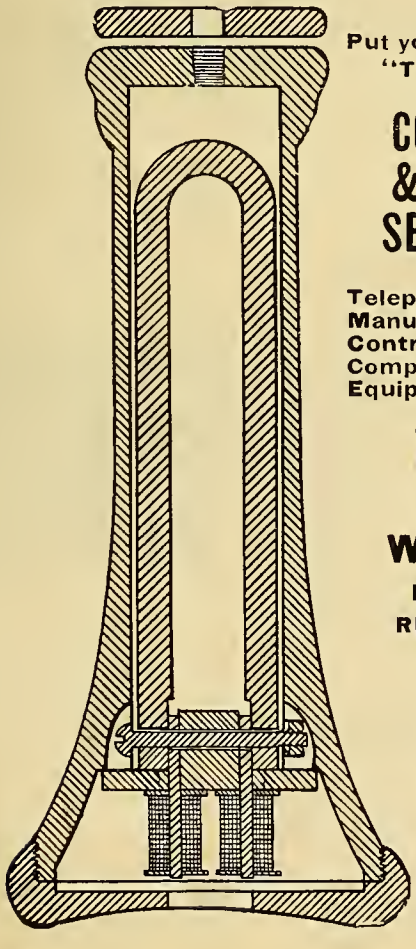
IN TROUBLE--WRITE US.

EDW. E. GRAVES, President.

METROPOLITAN STEAM BOILER COMPOUND MFG. CO.,

26 COURT STREET, BROOKLYN, N. Y.

We are in no
"TRUST" OR "COMBINATION."



Put your "TRUST" in

COUCH & SEELEY CO.,

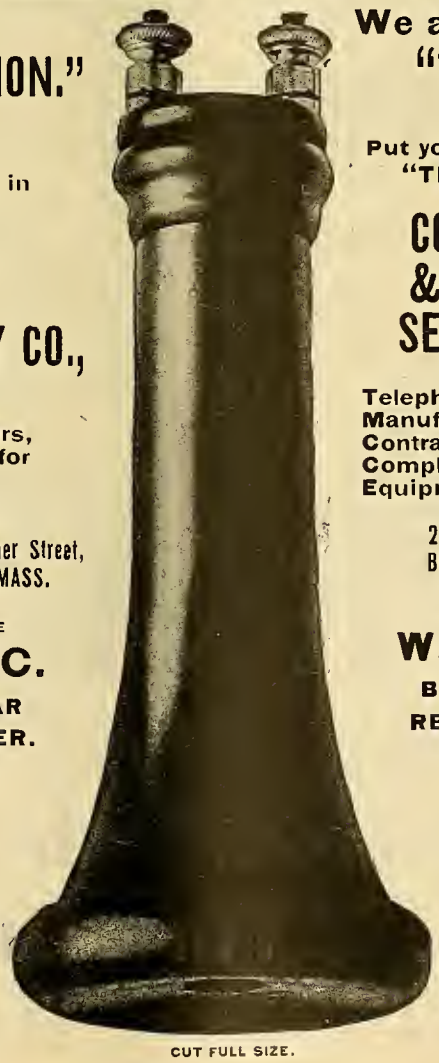
Telephone Manufacturers, Contractors for Complete Equipment,

212 Summer Street, BOSTON, MASS.

AND THE

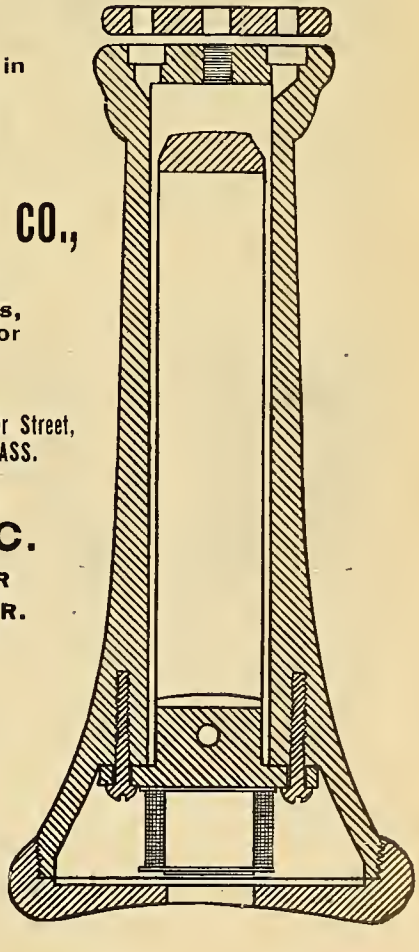
W. & C.

BIPOLAR RECEIVER.



CUT FULL SIZE.

We are in no
"TRUST" OR "COMBINATION."



Put your "TRUST" in

COUCH & SEELEY CO.,

Telephone Manufacturers, Contractors for Complete Equipment,

212 Summer Street, BOSTON, MASS.

AND THE

W. & C.

BIPOLAR RECEIVER.

The Williams-Abbott Electric Co.

MANUFACTURERS OF

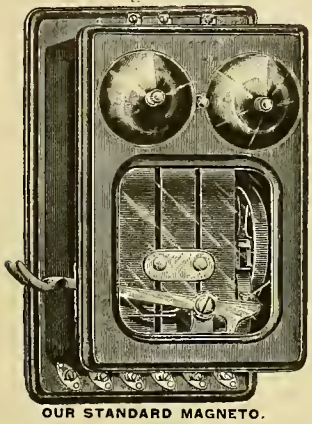
THE SANDS BI-POLAR RECEIVER

High Grade "Standard" and "Pony" Types, adapted to all kinds of Service.

HIGH EFFICIENCY, STRENGTH, DURABILITY AND SIMPLICITY.

INSIST UPON HAVING THE

WILLIAMS-ABBOTT MAGNETO BELL.



OUR STANDARD MAGNETO.

Perfect Electrically and Mechanically.
A Guarantee With Every One.
Will Outlive Two of the Ordinary Kind.

Get our prices and EXAMINE THE BELL before closing contracts.

PATENTS BOUGHT OR MANUFACTURED ON ROYALTIES. Correspondence Solicited.

Our Perfected High-Grade Transmitter

IS NOW READY FOR DELIVERY. SEND FOR SAMPLE.

THE WILLIAMS-ABBOTT ELECTRIC CO., 8, 10 and 12 Columbus Street, CLEVELAND, OHIO, U. S. A.

PLEASE MENTION THE WESTERN ELECTRICIAN IN WRITING TO ADVERTISERS.

LESCHEN-MACOMBER-WHYTE CO.,

19 and 21 South Canal St.,

CHICAGO.

HEADQUARTERS FOR

TELEPHONE WIRE

Galvanized Steel Strand.

Boston Cable Hangers.

Turn Buckles.

WE CARRY A LARGE STOCK.
WRITE US.

Crosby Clips.

DEARBORN { Drug and Chemical Works. Laboratories. Water Chemists. Vegetable Boiler Compound.

ALL KINDS OF ANALYSIS. OILS A SPECIALTY. WATERS FREE.

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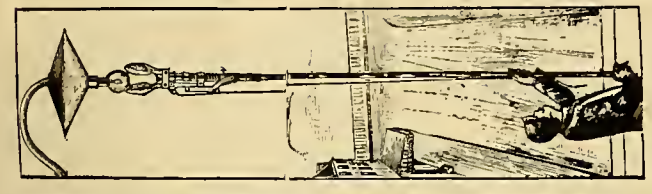

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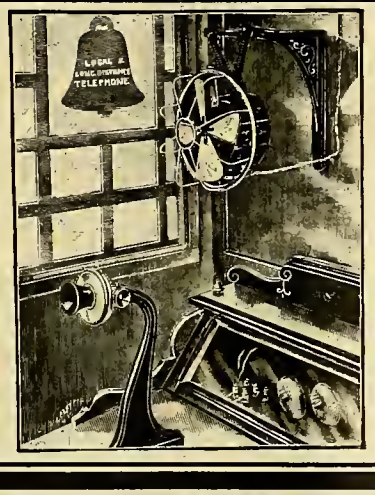

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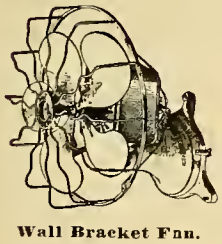

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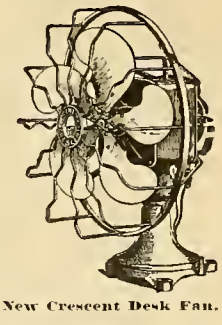

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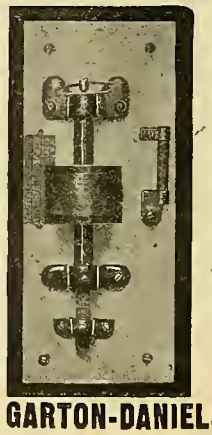

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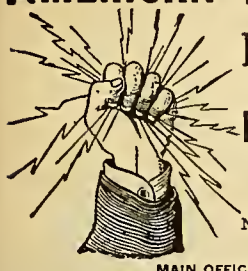

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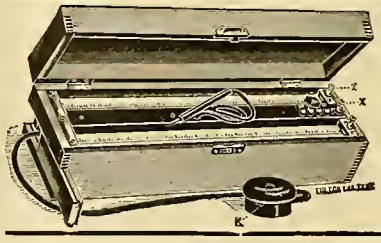

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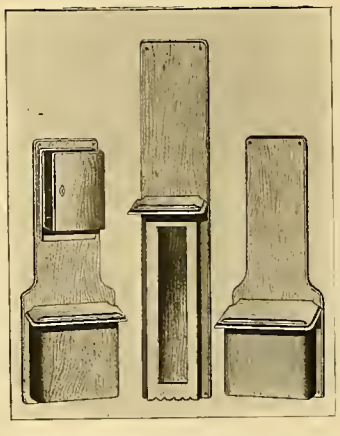

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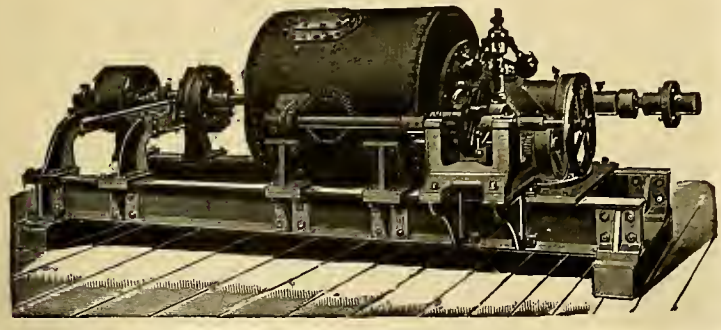

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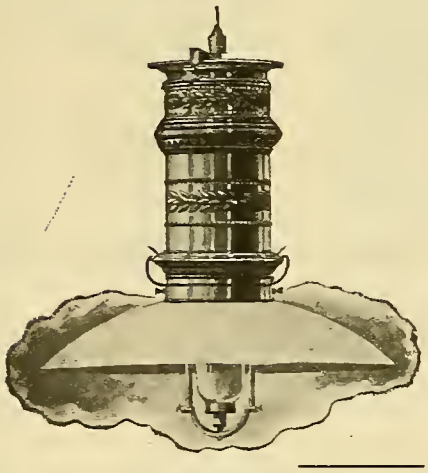

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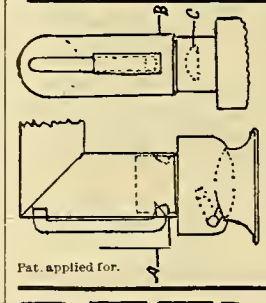

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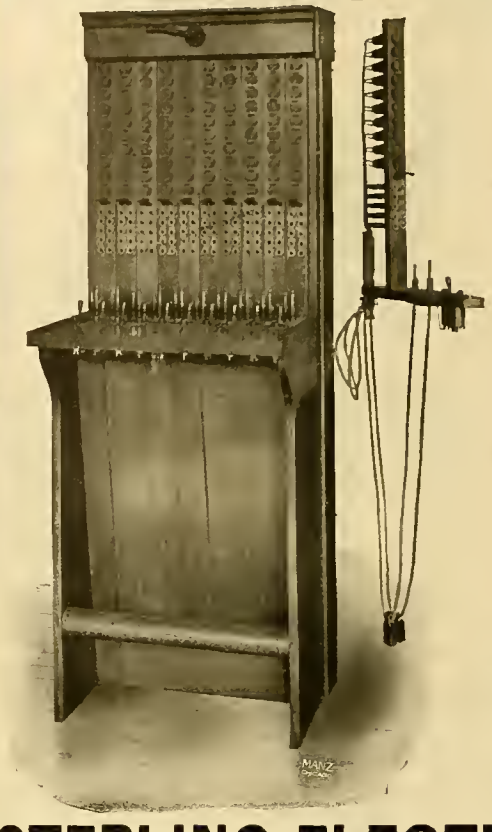

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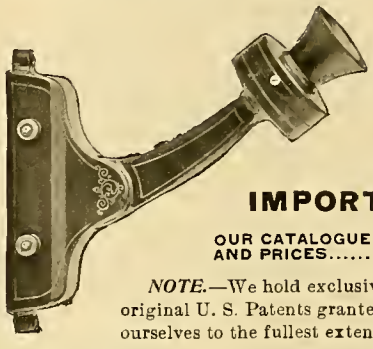

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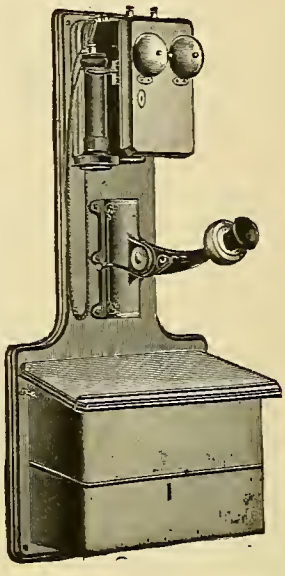

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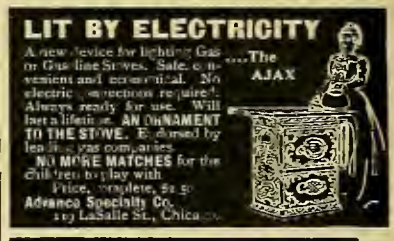

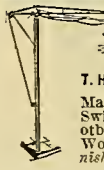

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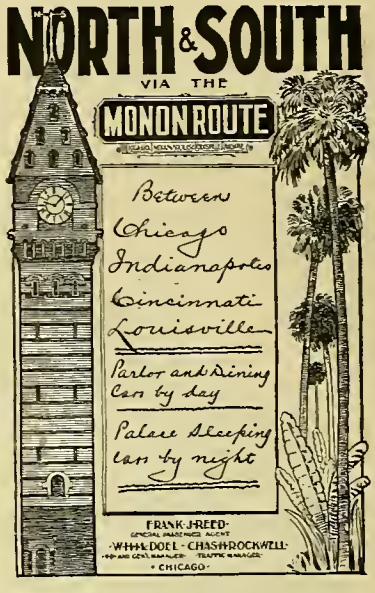

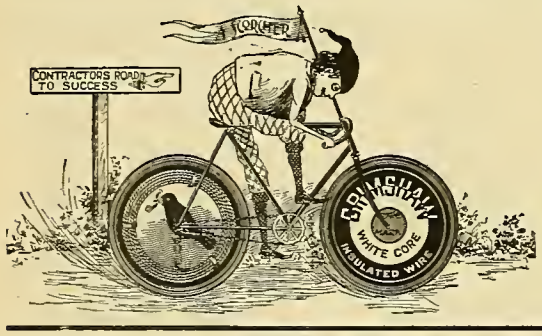

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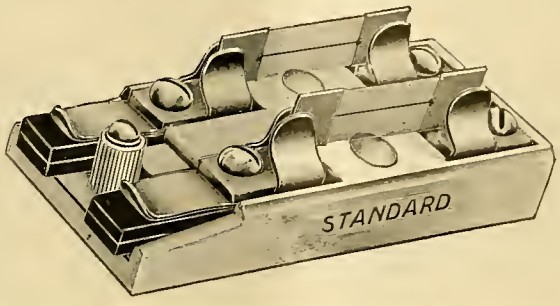

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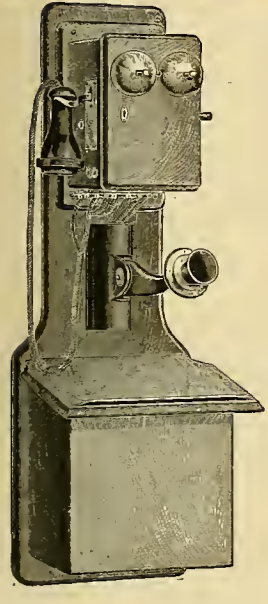

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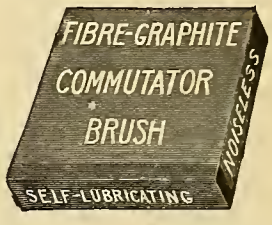

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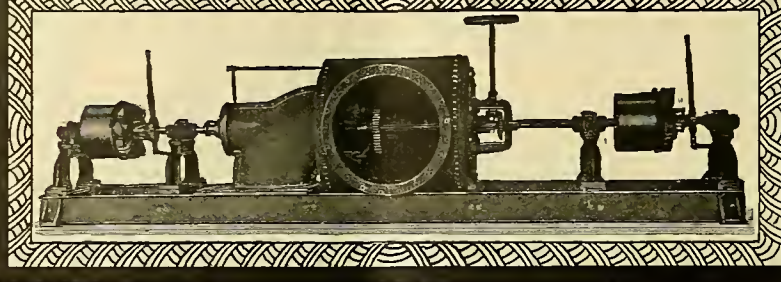

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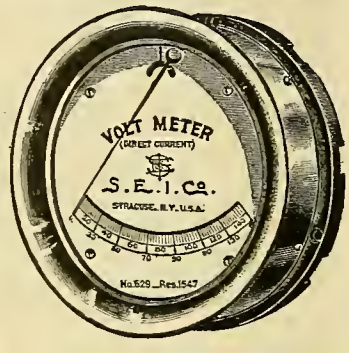

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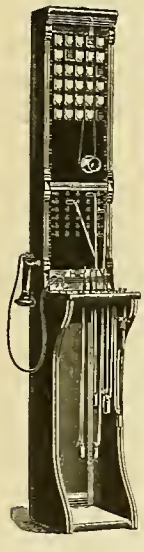

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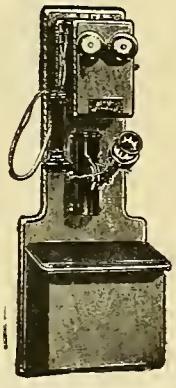

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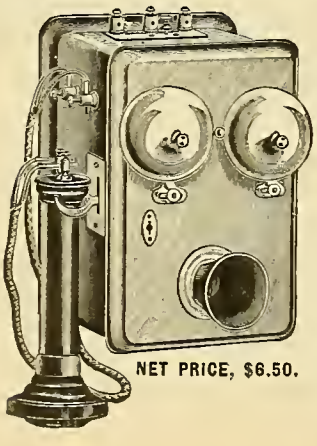

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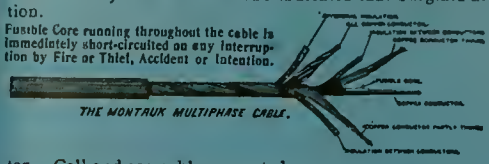

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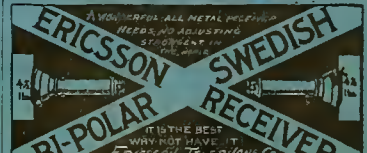

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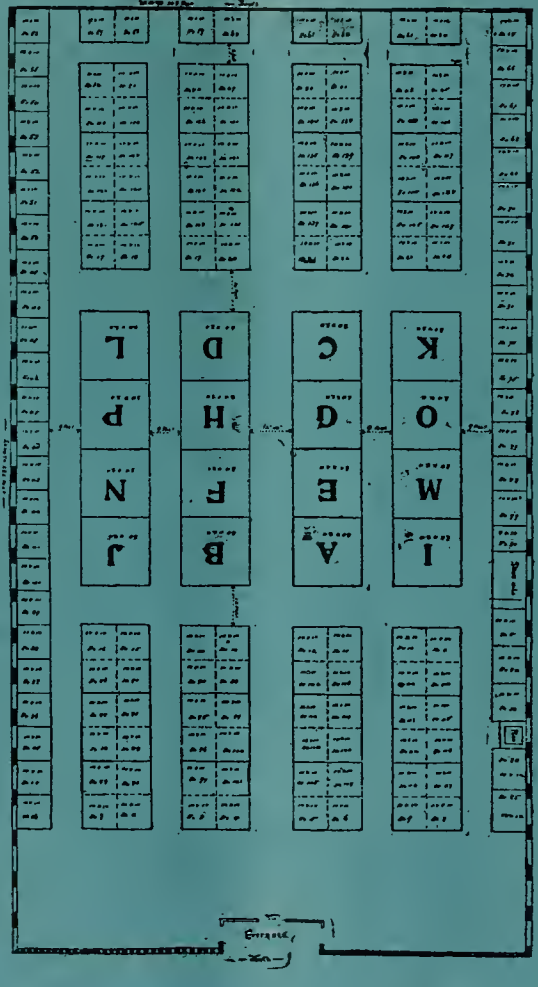

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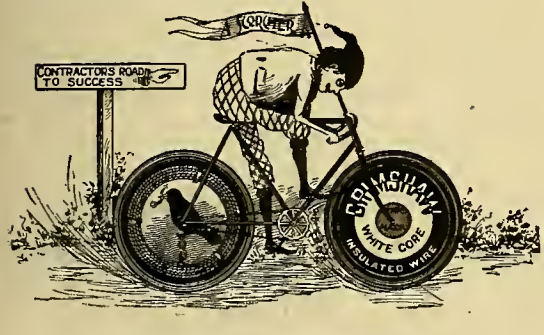

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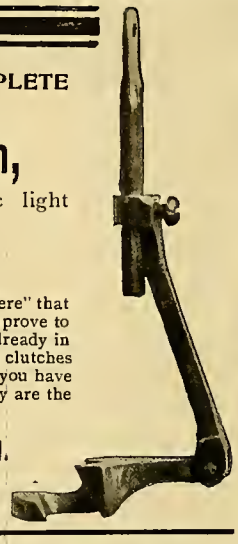

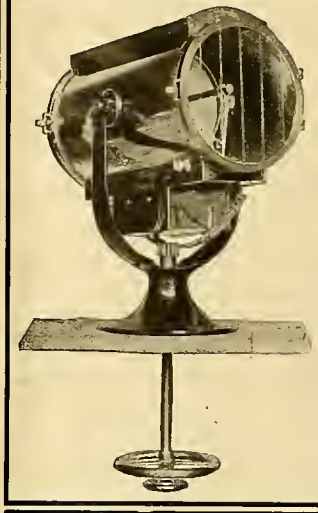

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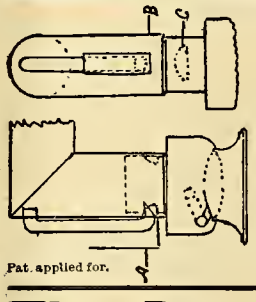

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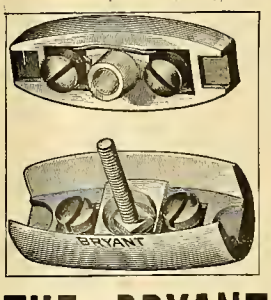

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LIGHT, HEAT, POWER, AND ELECTRICAL CONSTRUCTION
THE WICK AVENUE

YOUNGSTOWN, OHIO, June 19th, 1899.

Wagner Electric Mfg. Co.,
2017 Locust St.,
St. Louis, Mo.

Gentlemen:--

Replying to yours of a recent date regarding the operation of your single phase induction motors on our lines, we may say that our silence is satisfaction.

The Motors have given absolutely no trouble, and have required no particular attention on our part.

The minimum cost, and convenience of installation on ordinary single phase lighting circuits, fed by a common transformer system, is to be commended.

Yours truly,
THE YOUNGSTOWN ELECTRIC LIGHT CO.,
J. H. Perkins
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ALSO GET OUR BULLETIN No. 26, ON THIS SAME SUBJECT. . . . . .

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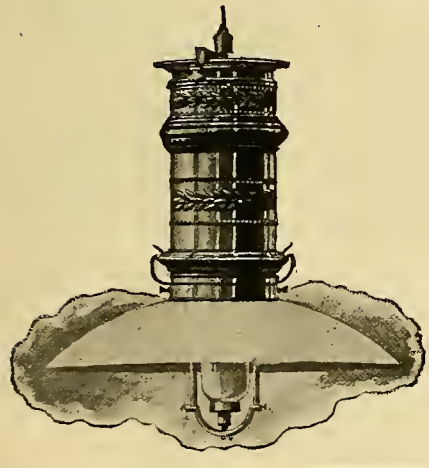

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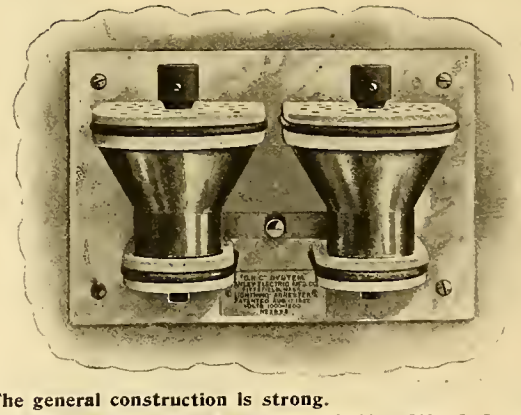

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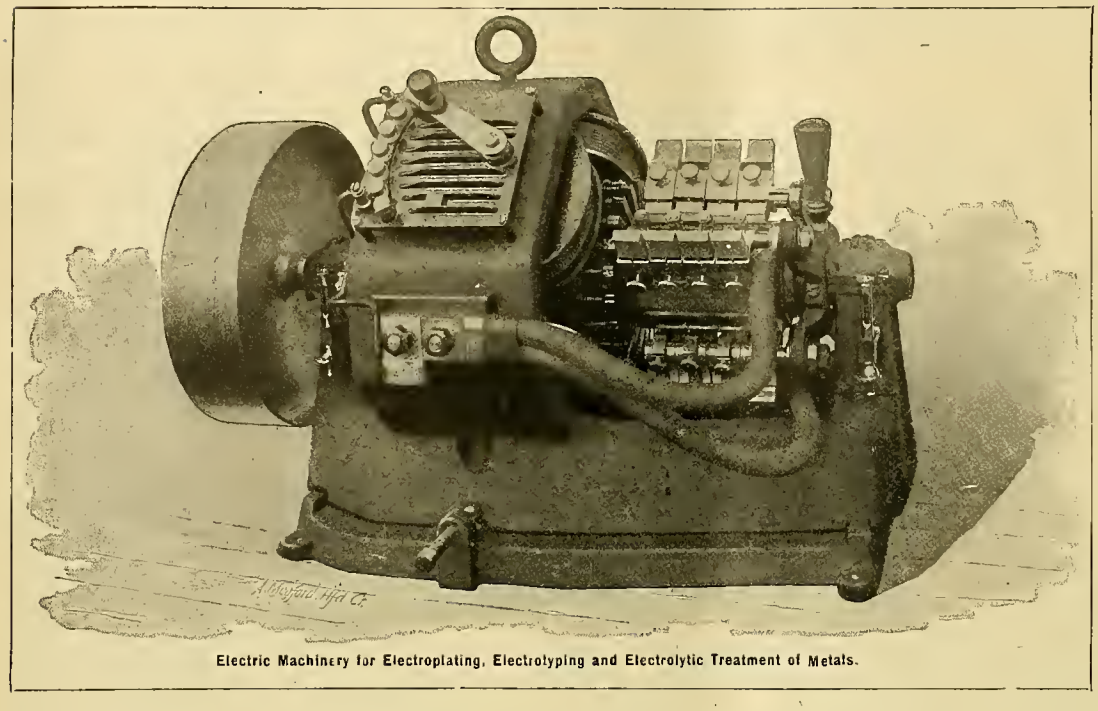

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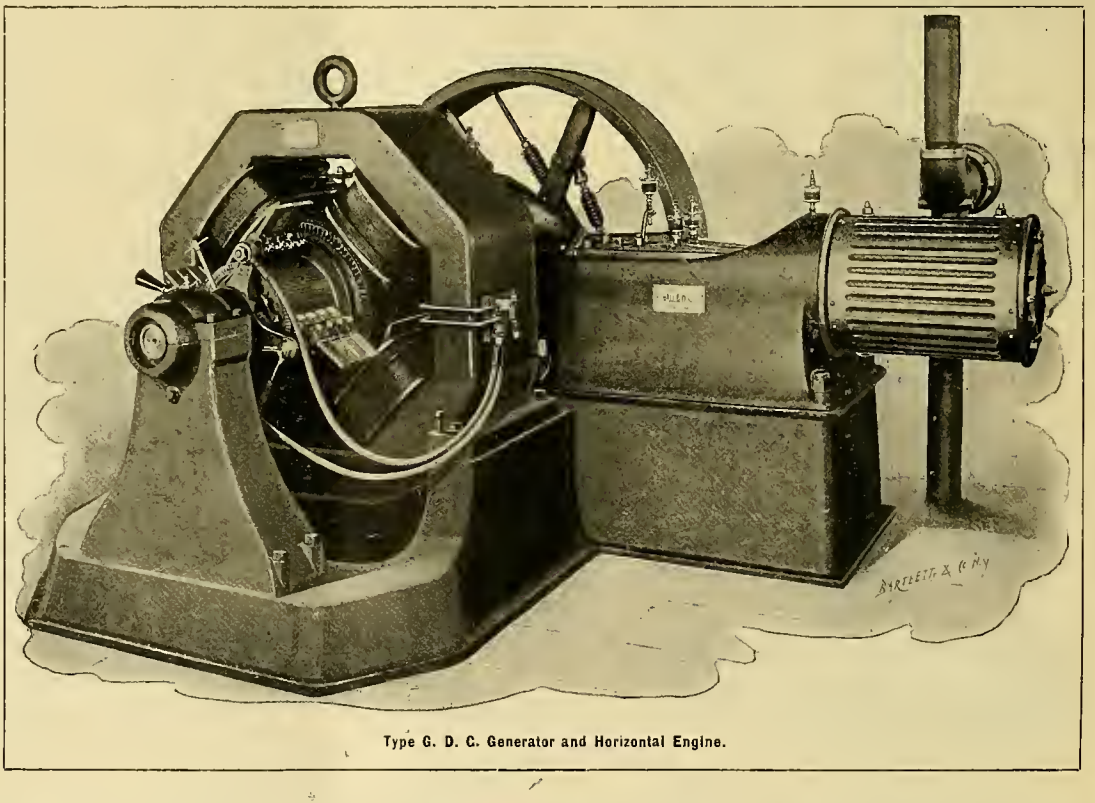

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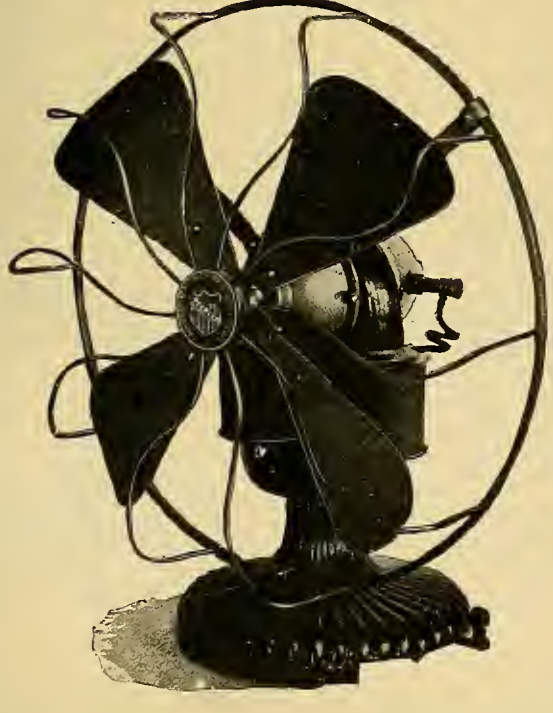

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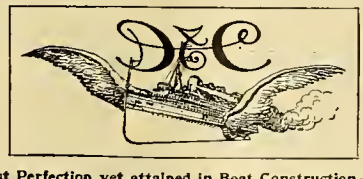

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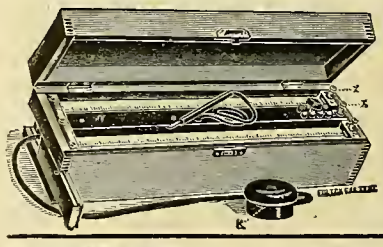

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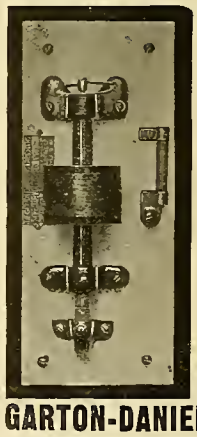

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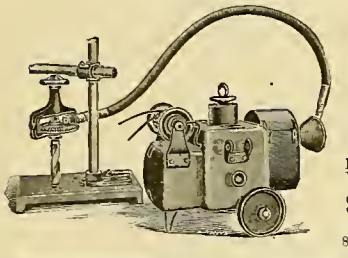

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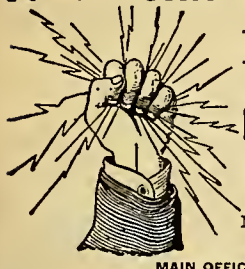

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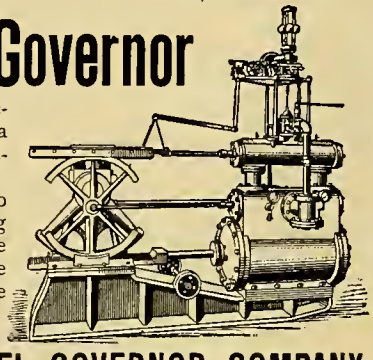

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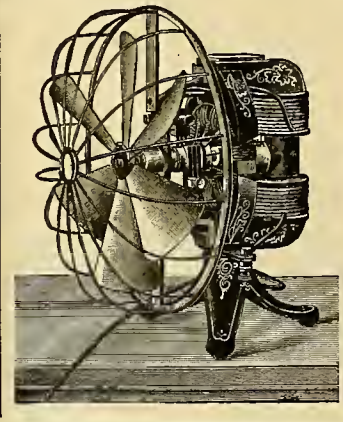

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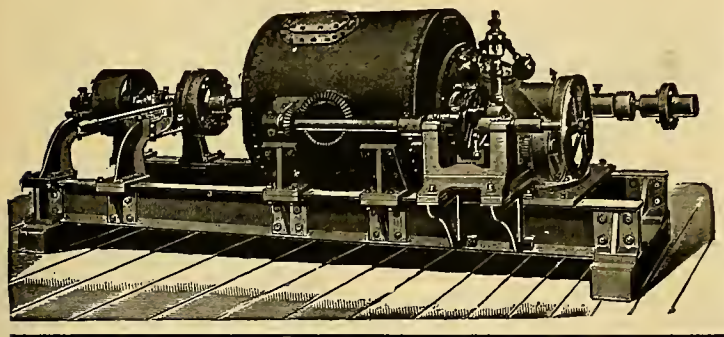

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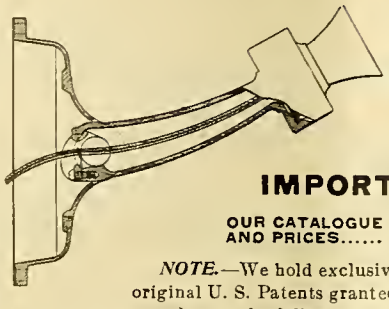

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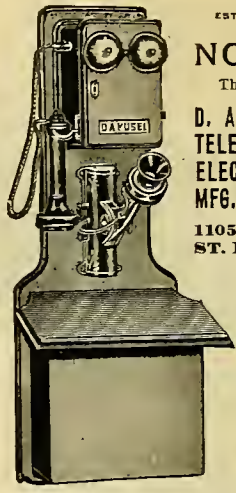

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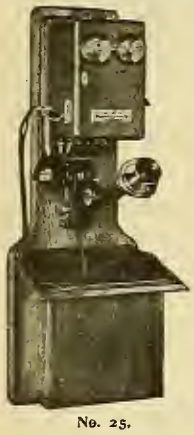

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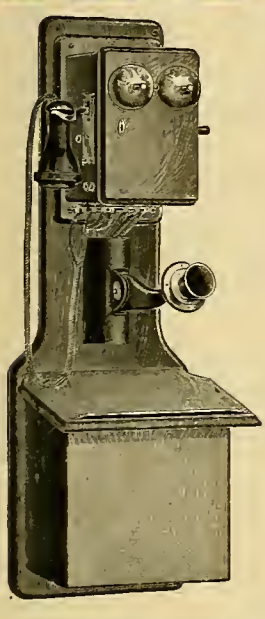

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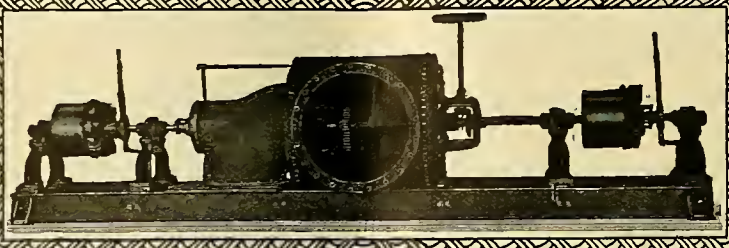

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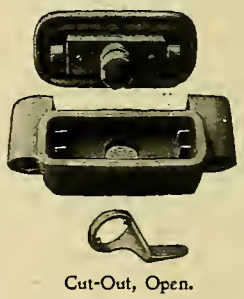
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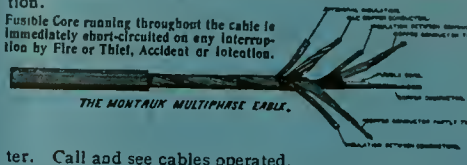

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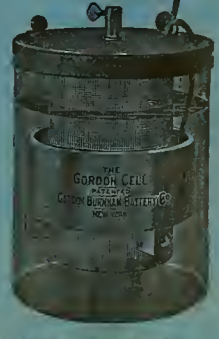

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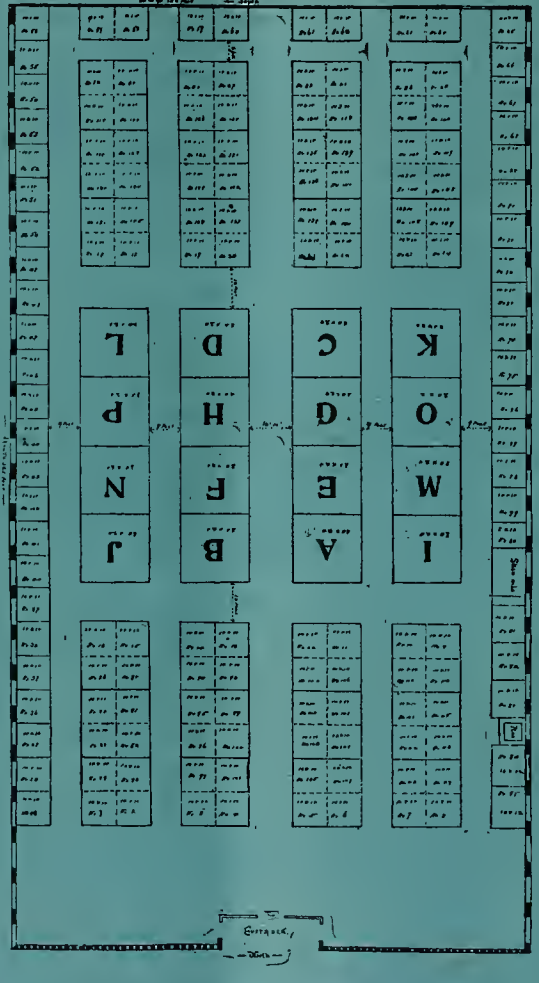

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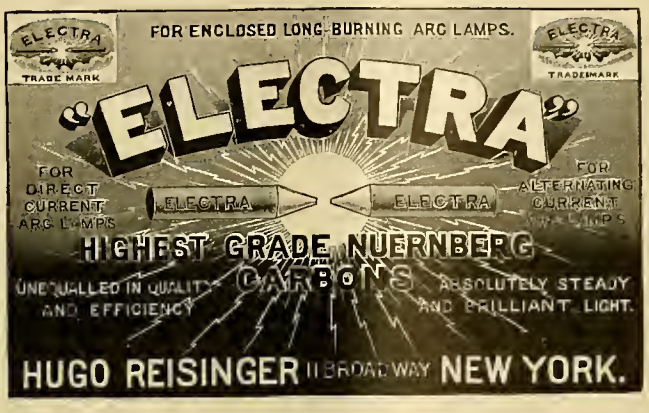

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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76 MARKET STREET, CHICAGO.

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HARDY LAMP COMPANY. PITTSFIELD, MASS.

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GOLDMARK & WALLACE.
121 WORTH ST. NEW YORK.
AGENTS FOR "KOCH" WOVEN WIRE DYNAMO BRUSHES.

All Careful Engineers use MONA COMMUTATOR COMPOUND, A perfect lubricator and spark preventer. Prepared only by
TROTTER'S MONA MANUFACTURING CO., Limited,
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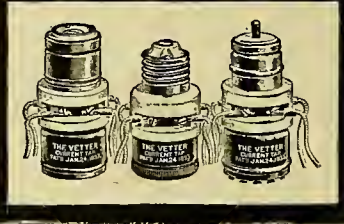
OF EVERY DESCRIPTION
THE WALLACE BARNES CO.,
ESTABLISHED 1857 BRISTOL, CONN., U. S. A.

The Vetter Current Tap.

A Tapping Plug and Lamp Socket Combined.

For Sale By All Electrical Supply Houses.



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A simple and safe device for tapping and carrying the current from any electric light fixture to Motors, Drop-lights and other electrical devices WITHOUT THE LOSS OF LAMP IN FIXTURE. Adapted to any system of electric lighting. When ordering, state what socket is used. Each tap is packed, with full directions, in a neat box.

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604 Nicollet Ave., Minneapolis. 360 St. Peter St., St. Paul.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

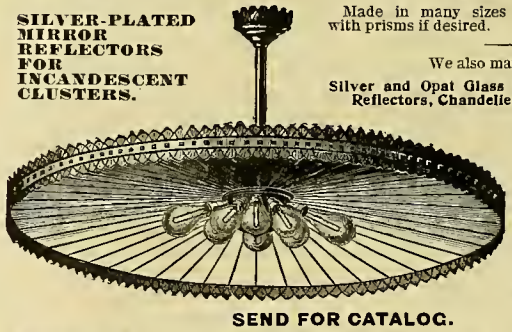
HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

REFLECTORS!

SILVER-PLATED MIRROR REFLECTORS FOR INCANDESCENT CLUSTERS.



Made in many sizes and styles. Trimmed with prisms if desired.

We also manufacture
Silver and Opal Glass Inverted Double Cone Reflectors, Chandeliers and Sun Burners
For lighting and ventilating
Churches, Theatres, Halls and Public Buildings.

Street and Ornamental Sign Lamps of Every Kind for Oil, Gas or Gasoline. Border Lights, Bunch Lights, Foot Lights and Gas Stands for Theatres.

SEND FOR CATALOG.

AMERICAN REFLECTOR & LIGHTING COMPANY,
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Your T.-H. arc lamps ARE NOT COMPLETE unless they are equipped with the

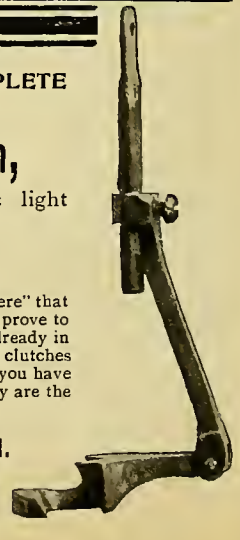
Knutson Gravity Clutch,

Acknowledged by the leading electric light plants to be

THE CLUTCH.

Send for a sample and put it in "that lamp over there" that has been giving you so much trouble, and let us prove to you that this is no fake. There are thousands already in use. Of course you think the various kinds of clutches you are now using are allright, but just wait till you have tried ours; that is all we want you to do. They are the CHEAPEST and the BEST.

A. W. KNUTSON & CO., Galesburg, Ill.



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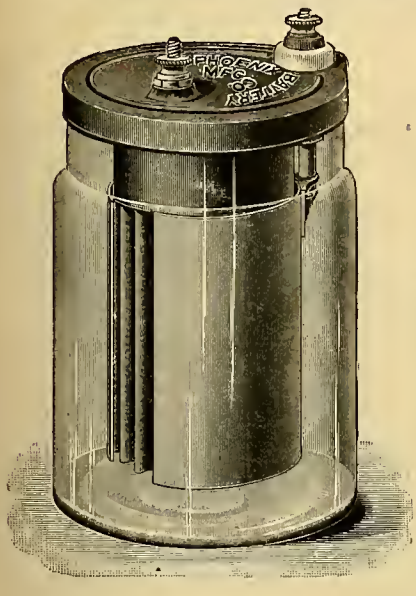

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Hundreds of thousands are used to-day throughout the United States—

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Not a single report of one single cell defective or inefficient—

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STANDARDIZED BY RESULTS.

ALL STANDARD SIZES

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Will neither slip, run off, nor need taking up, and its transmitting capacity is only limited by the strength of the belt.

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Advance Specialty Co.
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Western Electric Co.

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Western Elect. Supply Co.

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Cling-Surface Mfg. Co.
Mass. Chemical Co.
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Ruxton, Robert.

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Besly & Co., Chas. H.
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Swarts Metal Refining Co.

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Queen & Co.
Weston Electrical Inst. Co.

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Cary Spring Works.

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Electric Storage Battery Co.

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Therien Tool Works.

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Kuhlman Electric Co.
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Western Electric Co.
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Worcester Polytechnic Inst.

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Vulcanized Fibre.
Vulcanized Fibre Co.

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Queen & Co.
Victor Electric Co.

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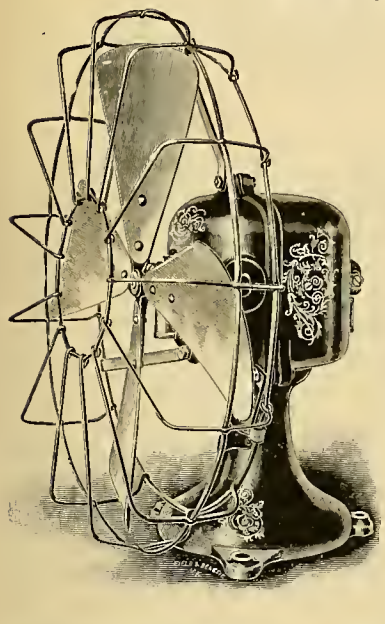
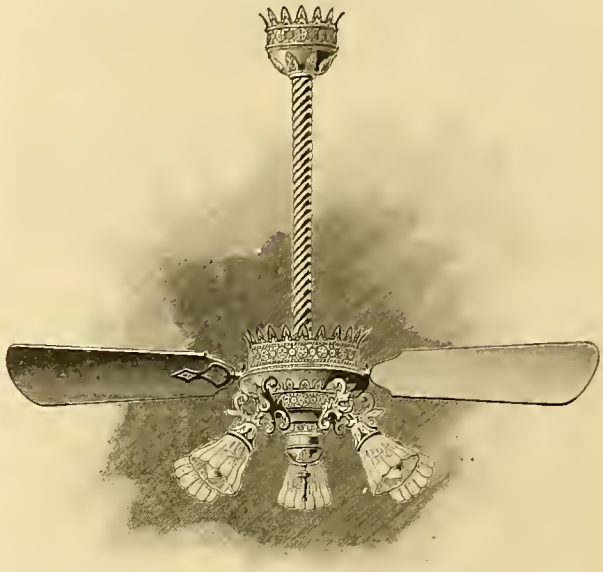
DIEHL ELECTRIC FANS,

FOR ALL CIRCUITS, EXCEPT ALTERNATING.



Our line of Electric Fans for ALL purposes for the present season is the most complete that we have ever placed in the market, and the high standard of our product has been strictly upheld.

Our fans are the cheapest because they are absolutely the best made: wear longest, require less outlay for repairs and show a higher efficiency than any other fan. This statement is fully sustained by the past record of our fans. Our place has always been in the lead and we intend to maintain that position.



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DIEHL MANUFACTURING CO.

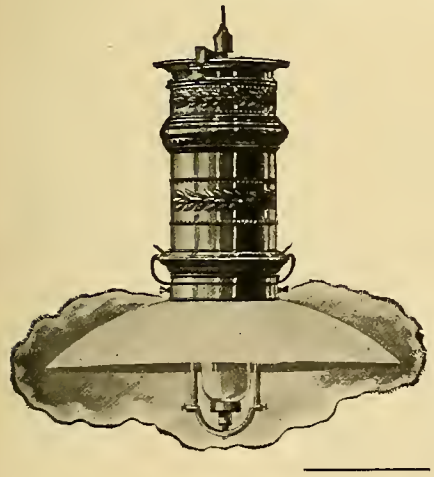
SHOW ROOMS { 561-563 Broadway, NEW YORK. 192-194 Van Buren St., CHICAGO. 128-132 Essex St., BOSTON.

MAIN OFFICE AND WORKS:

ELIZABETHPORT, N. J.

THE MORRIS ENCLOSED ARC LAMPS

For Constant Potential Circuits are Superior in Points of



SIMPLICITY, ECONOMY, ELEGANCE, LIGHT.

You should see them at the Electrical Exhibition.

THE MORRIS ARC LAMP CO.,

CHESTER, PA.

SELLING AGENCIES:

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Doubleday-Hill Electric Co., 535 Wood Street, Pittsburg, Pa.
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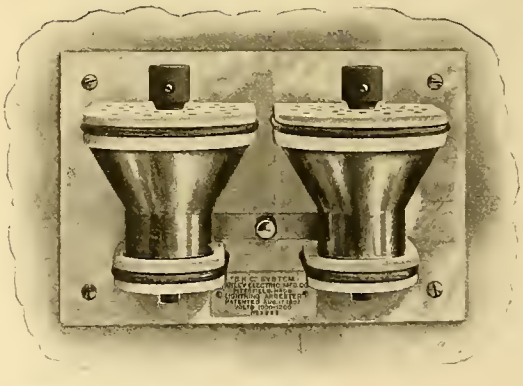

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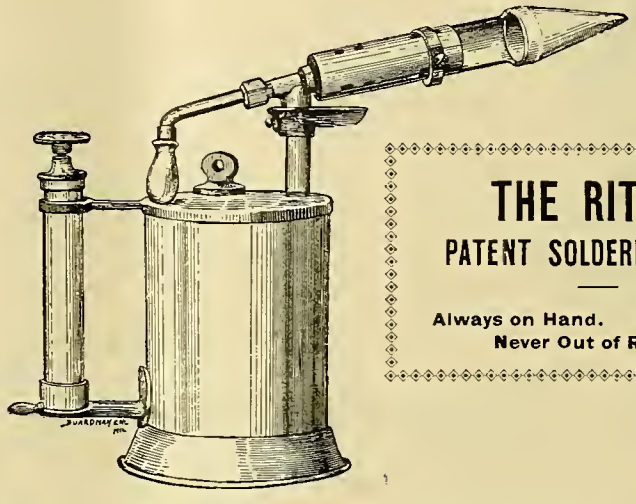

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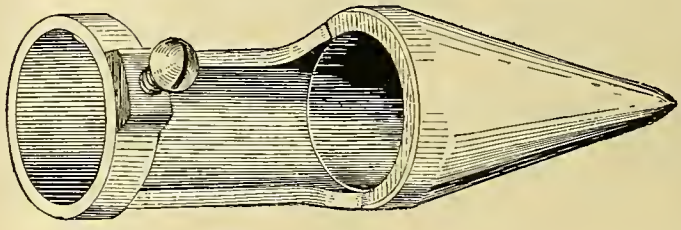

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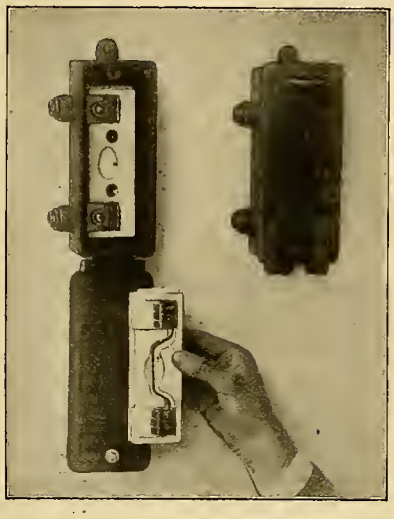

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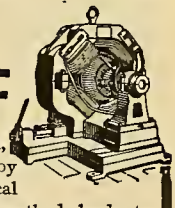

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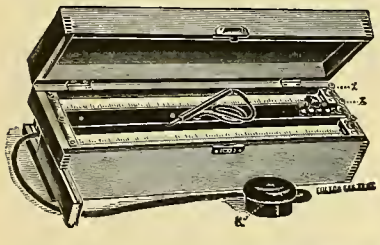

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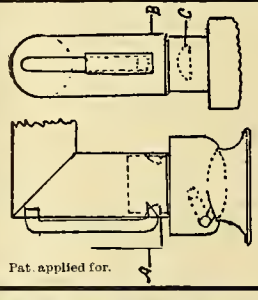

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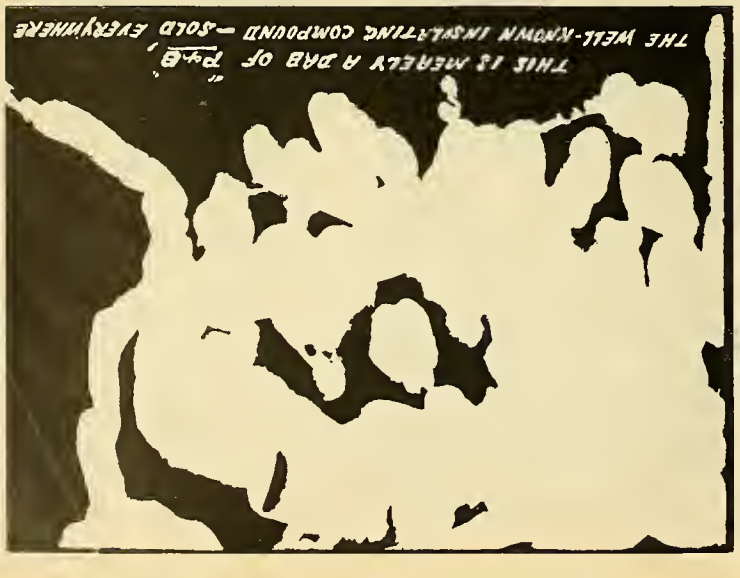

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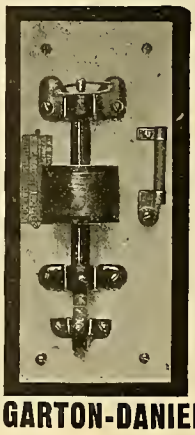

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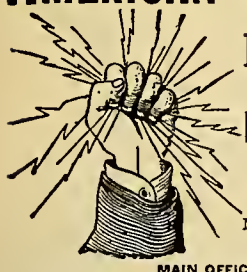

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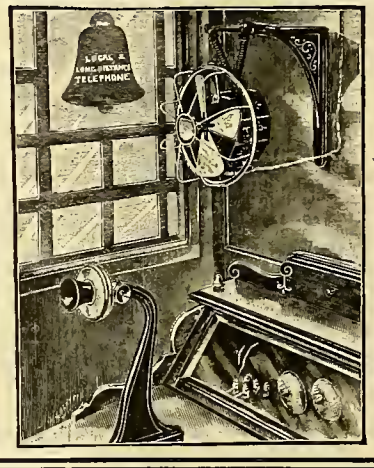

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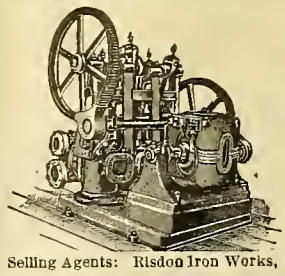

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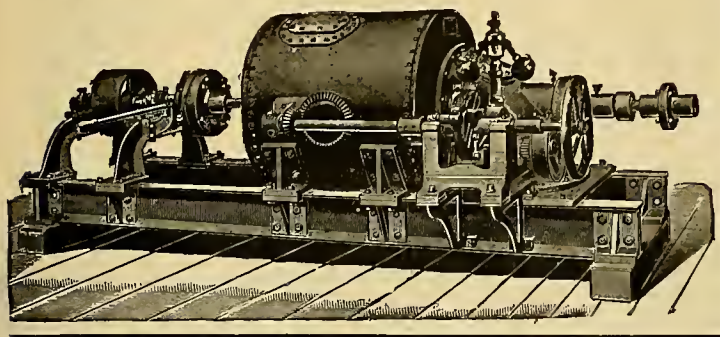

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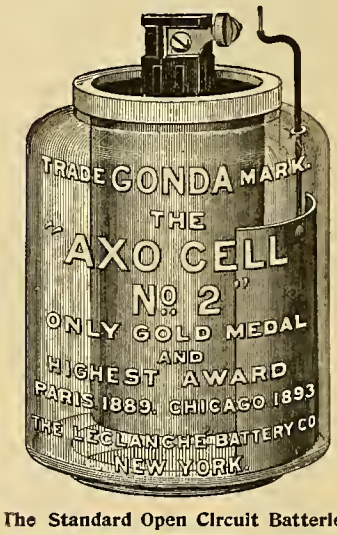

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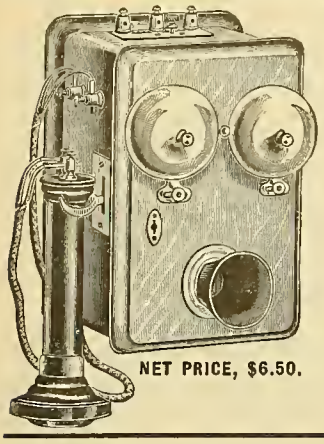
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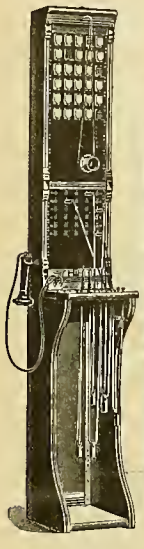

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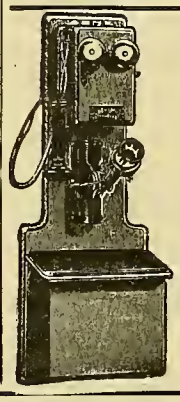

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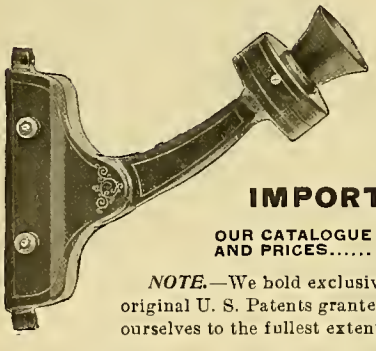

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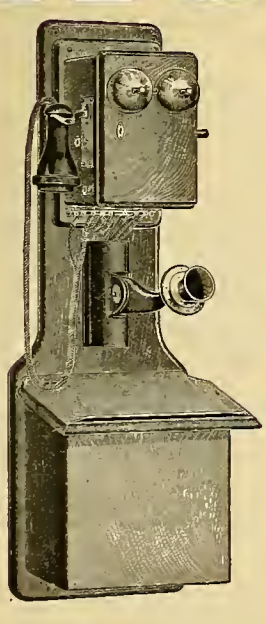

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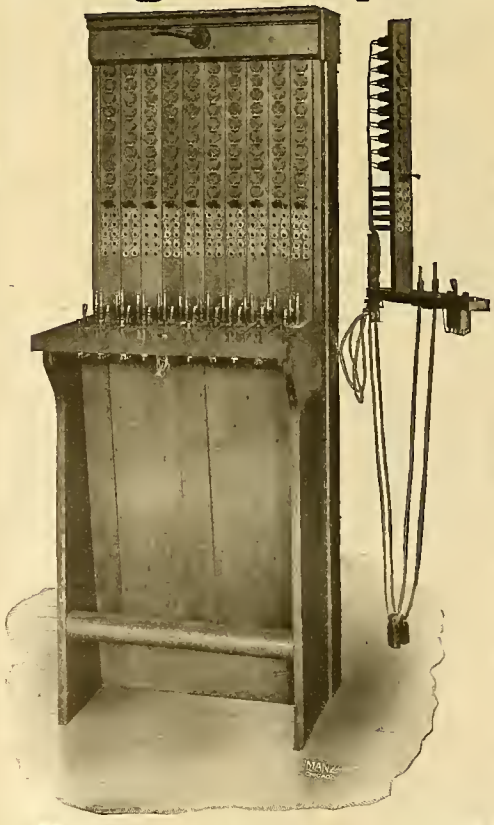

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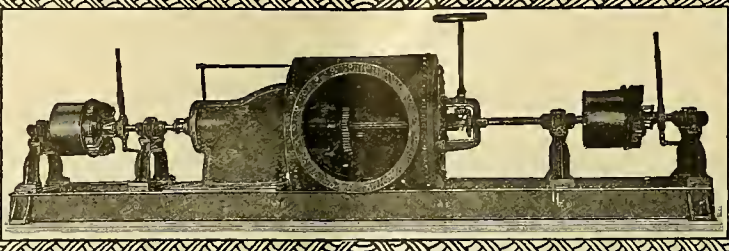

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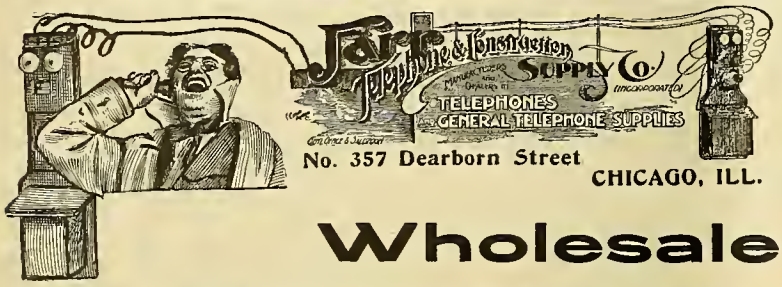

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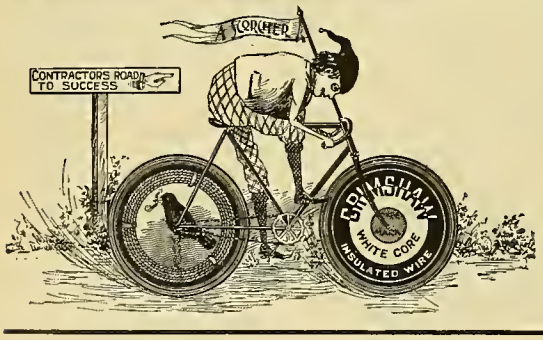

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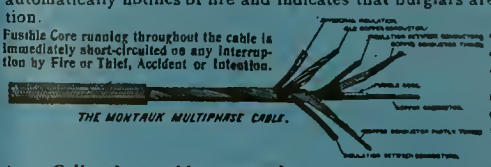

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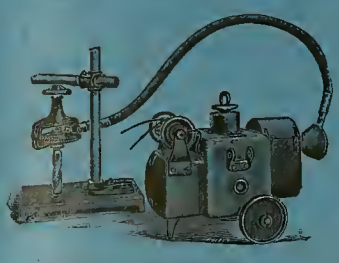

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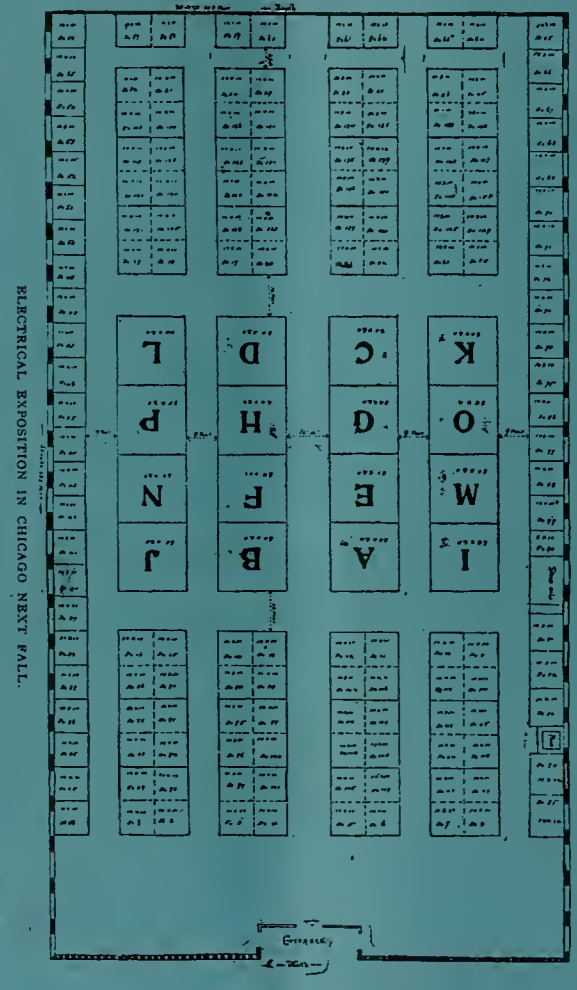

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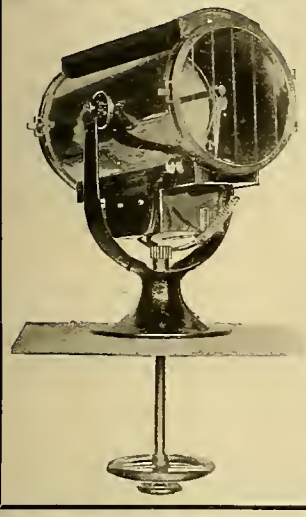

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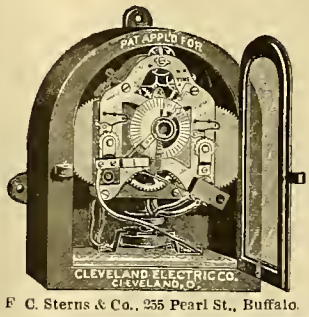

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COOL BREEZES
ALL SUMMER.
THE PARAGON FAN
GIVES THEM TO YOU AT A SMALL COST.

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"HARDY" INCANDESCENT LAMPS.
HARDY LAMP COMPANY, PITTSFIELD, MASS.

TROTTER'S COMMUTATOR COMPOUND.
GOLDMARK & WALLACE.
121 WORTH ST. NEW YORK.
AGENTS FOR "KOCH" WOVEN WIRE DYNAMO BRUSHES.

All Careful Engineers use MONA COMMUTATOR COMPOUND,
A perfect lubricator and spark preventer. Prepared only by
TROTTER'S MONA MANUFACTURING CO., Limited,
65 West Broadway New York City.

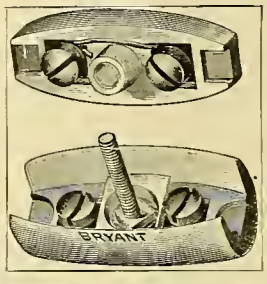
SMALL SPRINGS
OF EVERY DESCRIPTION
THE WALLACE BARNES CO.,
ESTABLISHED 1857 BRISTOL, CONN., U. S. A.

DOES
Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,
CONSULTING ENGINEERS,
TROY, OHIO.

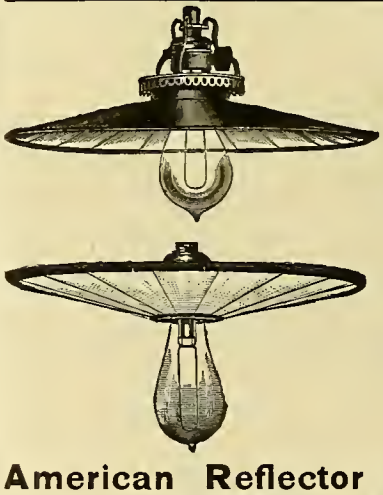
The Bryant Bug Cut-Out.



Concave-head contact screws in the base, and convex in the cap, insure a perfect contact where the two connecting wires are of different gauge.

The cover, being held in place by but one nut, can be readily removed for fusing.

THE BRYANT ELECTRIC COMPANY,
Bridgeport, Connecticut, and Chicago, Illinois.



SILVER-PLATED MIRROR REFLECTORS.

A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

GET OUR PRICES.

American Reflector & Lighting Co.,
271-273 FRANKLIN STREET, CHICAGO.

Your T.-H. arc lamps ARE NOT COMPLETE unless they are equipped with the

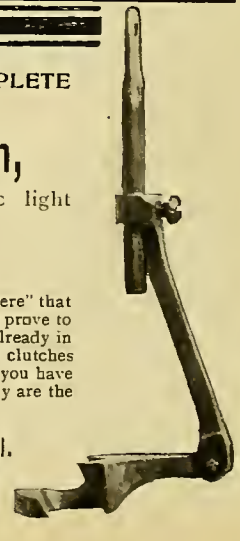
Knutson Gravity Clutch,

Acknowledged by the leading electric light plants to be

THE CLUTCH.

Send for a sample and put it in "that lamp over there" that has been giving you so much trouble, and let us prove to you that this is **no fake.** There are thousands already in use. Of course you think the various kinds of clutches you are now using are allright, but just wait till you have tried ours; that is all we want you to do. They are the CHEAPEST and the BEST.

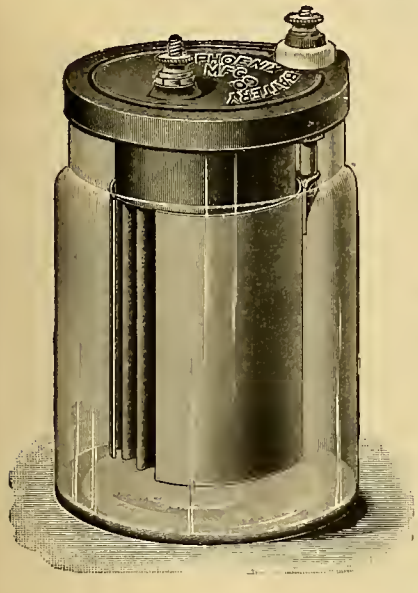
A. W. KNUTSON & CO., Galesburg, Ill.



OUR PHOENIX No. 1.

E. M. F., 1.55 Volts. AMPERAGE, 8 and Over.

Is the Strongest Open-Circuit Battery Ever Made.



We have sold our Phoenix No. 1 Batteries in lots of 6,000 and 12,000 single sales—

That's Salesmanship.

Hundreds of thousands are used to-day throughout the United States—

That's Popularity.

Not a single report of one single cell defective or inefficient—

That's Mechanical Skill.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS.

NET—NO DISCOUNT

On the Quality of

Okonite Wires AND Products

They are made of the
BEST OBTAINABLE MATERIALS,
By the Highest Grade
of Operatives with the
MOST IMPROVED MACHINERY.

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...CHICAGO...

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OKONITE IT NEVER DISAPPOINTS

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QUALITY UNEQUALED.
FACTORY PRODUCTION TRIPLED.

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MANUFACTURERS OF

Direct-Current Dynamos and Motors.

Bipolar from 1 kilowatt to 40 kilowatts. Multipolar, 5 kilowatts to 100 kilowatts.

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Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We make a specialty of apparatus for the transmission of Electrical Power through factory or other buildings.

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PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
ELMIRA, S. N. Blake.
SAN FRANCISCO, CAL., California Elec. Works, 409 Market St.
NEW YORK OFFICE, Singer Bldg., 149 Broadway.
BOSTON, G. M. Angier & Co., 64 Federal St.
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CINCINNATI, Nevada Bldg. John A. Stewart.

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CLING-SURFACE
IS USED

THE DAYS OF TIGHT BELTS ARE OVER.

No slipping, no hot boxes, no taking up. Belts run easy, slack and with greatly increased power.

Let us send you reports of tests by Prof. Carpenter of Cornell University.

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Leather Preserver Mfg. Corp.
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Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec. Sup. Co.
Peru Elec. Mfg. Co.
Victor Electric Co.
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Western Elect. Supply Co.

Globes and Electrical Glassware.
Central Electric Co.
Phoenix Glass Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Joe.
Holmes Fibre-Graphite Co.

Insulators and Insulating Materials.
Bryant Electric Company.
Central Electric Co.
Chicago Edison Co.
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Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
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American Electrical Works.
Central Electric Co.
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Montauk Multiph. Cable Co.
National India Rubber Co.
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Mining Apparatus, Elec.
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Chicago Rheostat Co.
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Patent Attorneys.
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Ruxton, Robert.

Phosphor Bronze.
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Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.
Goldsmith Bros.

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Berthold & Jennings.
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Naugle, Holcomb & Co.
Perrizo & Sons.
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Porcelain.
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Peru Elec. Mfg. Co.

Refiners.
Swaris Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
Chicago Edison Co.
Hodge-Walsh Elec. Eng. Co.
Stewart Electrical Co.

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Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Ind. Arc Lt Co.
Iron Clad Resistance Co.
Victor Electric Co.
Westinghouse El. & Mfg. Co.

Search-Lights.
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Second-Hand Machin'y.
Hodge-Walsh Elec. Eng. Co.
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Shades.
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American Battery Co.
Electric Storage Battery Co.

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New York Insulated Wire Co
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Telephones, Telephone Material and Switchboards.
Allen-Hussy Co.
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American El. Telephone Co.
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Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Holyoke & Holyoke.
Kokomo Tel. & El. Mfg. Co.
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Western Electric Co.
Western Elect. Supply Co.
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Trucks, Electric Car.
General Electric Co.
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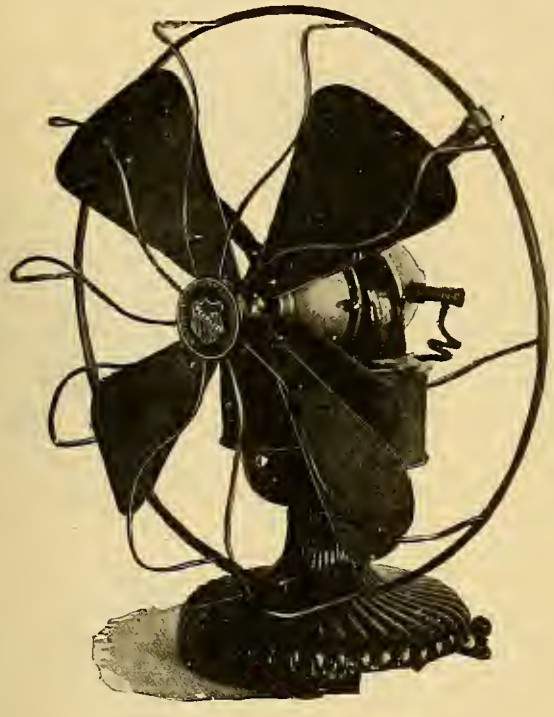
Peerless Fan Motor.



The Handsomest and Most Efficient on the Market.

12-inch fan consumes only **35 WATTS** running 1,850 revolutions per minute. PRICE RIGHT.

Immediate delivery from stock in all large cities.

W. S. HULL, Agent,
144 FRANKLIN STREET, CHICAGO.

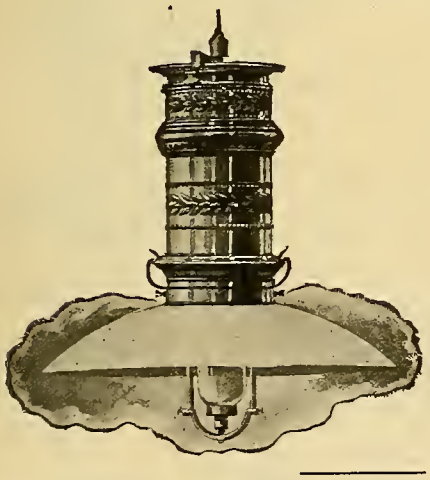
THE WARREN ELECTRIC AND SPECIALTY CO.,

MFR. PEERLESS { Incandescent Lamps, D. C. Desk Fan Motors, Transformers.

WARREN, OHIO.

THE MORRIS ENCLOSED ARC LAMPS

For Constant Potential Circuits are Superior in Points of



SIMPLICITY, ECONOMY, ELEGANCE, LIGHT.

You should see them at the Electrical Exhibition.

THE MORRIS ARC LAMP CO.,

CHESTER, PA.

SELLING AGENCIES:

The Manufacturers' & Inventors' Electric Company, 96-98 Fulton Street, New York.
Doubleday-Hill Electric Co., 535 Wood Street, Pittsburg, Pa.
W. R. Garton Company, 315 Dearborn St., Chicago. J. C. M Lucas, 22 Light St., Baltimore, Md.

THE S. K. C. ALTERNATING-CURRENT LIGHTNING ARRESTER.

The general construction is strong.

It is thoroughly insulated, WITHOUT MOVING PARTS, and WITHOUT COILS or LARGE SERIES RESISTANCES to impede the lightning discharge to the ground.

OUTDOOR and INDOOR double-pole types.

Write for "Bulletin No. 104," fully describing these arresters, and dealing with the general subject of lightning protection for lines and apparatus.

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Electric Light and Power Apparatus,
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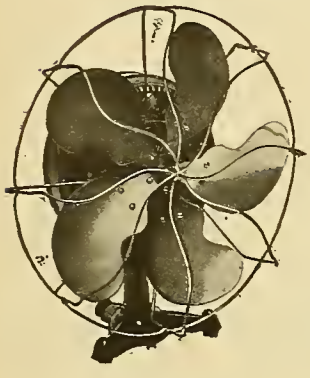

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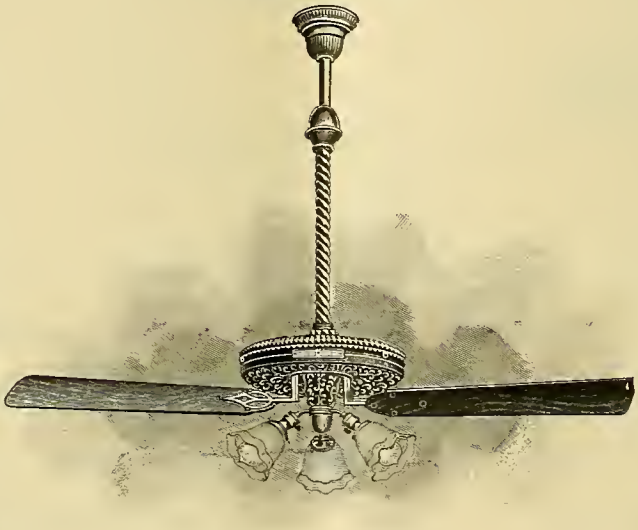

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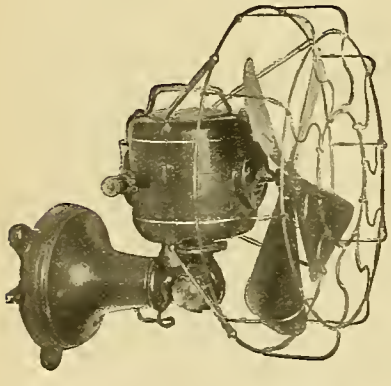

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Prompt shipments save you time and money.

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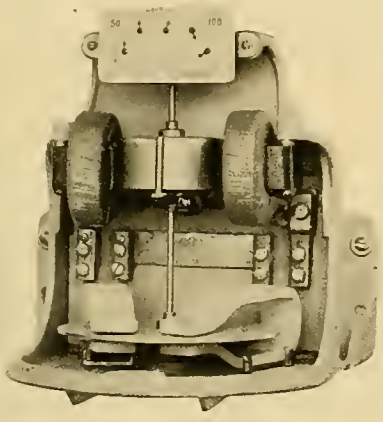

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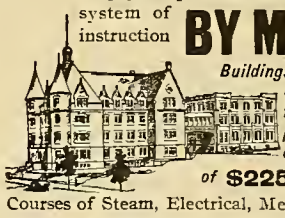

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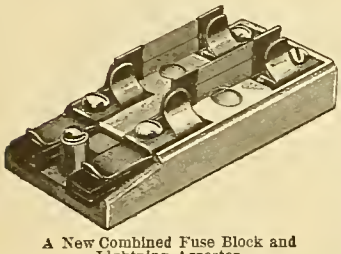

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CUSTOMERS PAY FOR ADVERTISING *AND THEREFORE APPRECIATE BREVITY*

Paiste Attachment Plugs have porcelain base and cap.
Paiste Rosettes have knife-switch contacts.
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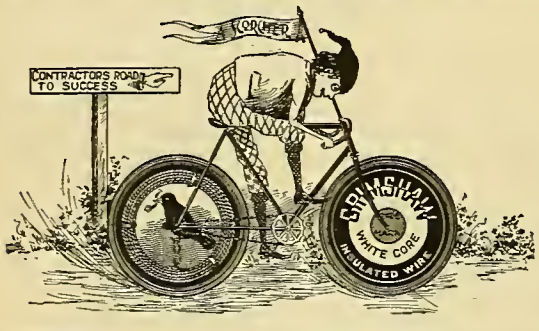

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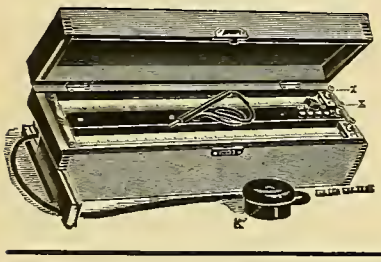

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No other instrument can meet such difficulties of stray magnetism and vibration.

A boy can use it. The brains are in the box.

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50 CENTS PER STICK. $5.00 PER DOZEN.

Upon Receipt of this COUPON we will Send FREE, Sample Stick.

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The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

ABSOLUTELY WILL NOT GUM THE BRUSHES....

It will put that high gloss on the commutator you have so long sought after.

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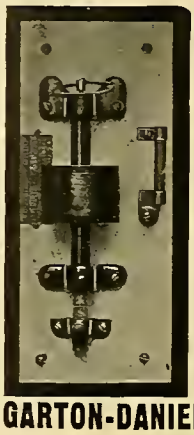

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You didn't order enough **LIGHTNING ARRESTERS.** Thought we were trying to crowd you in order to increase our sales.

You will have to come to it some day—and don't forget that **CARTON ARRESTER** people told you so.

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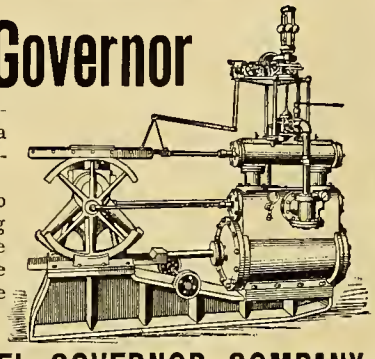

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We build governors adapted to all makes of water-wheels, working under all conditions. 70,000 horse power in use. We guarantee the best speed regulation which can be obtained under any conditions.

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IN THE LEAD — PIONEERS ALWAYS
Send for Catalogue of Carriages
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2,000 Rheostats always in stock from which immediate shipments of any size order can be made.

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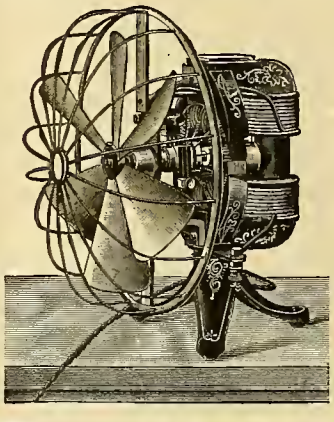

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The only efficient battery fan outfits on the market. Invaluable for the sick room.

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TAILORS' IRONS, LAUNDRY IRONS, HAT IRONS, CURLING IRON HEATERS, ETC. Also other Devices for Electrical Heating.
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2,000 LIGHTS.

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IT WILL PAY YOU

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

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Office and Factory: PAWTUCKET, R. I.

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A good telephone inspector, 700 'phones, in a lively city, about 200 miles from Chicago. Address "NEW 'PHONE," care Western Electrician, 510 Marquette Building, Chicago.

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Electrical engineer with business experience has money to invest. Wants to meet party in same line similarly situated. Address P. O. BOX 817. Chicago.

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An electrician for a first-class plant in a good live Western town, accustomed to alternating incandescent and direct-current series arc systems.

Must be competent and willing to do construction work, inside and outside wiring, make estimates, repair and adjust lamps, be a hustler and not afraid of work; steady and sober. Steady employment. Wages $75.00 per month, first year. None but competent men need apply. State age, experience, married or single and give refereuces. Address "B," care Western Electrician, 510 Marquette Building, Chicago.

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A position in electric-light plant by a young man of 23. One year experience. Can do wiring and line work. Good references. Address F. Z. N., care Western Electrician, 510 Marquette Building, Chicago.

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BY THE NORTH DAKOTA HOSPITAL FOR THE INSANE.

For one combined engine and dynamo—dynamo to have capacity of forty (40) kilowatts. M. P. 6, speed 300, voltage 125. Engine to be capable of running said dynamo with 80 pounds steam pressure, cutting at one-fourth.

Also for electrical supplies in separate bids, lists of which will be furnished on application. Bids will be received up to the first day of August, 1899, at the office of the Steward.

Terms cash.

JOHN MILSTED, Steward.

Dated Jamestown, N. D., July 8, 1899.

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For one standard boiler to carry 100 pounds of steam, boiler to be 16 feet long by 72 inches in diameter; and for steam heating and plumbing materials to fit out a new Ward and Laundry Building now under construction. Lists of kinds and quantities of materials will be furnished on application. Bids will be received up to 1 o'clock p. m., July 22, 1899, at the office of the Steward.

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Dated Jamestown, N. D., July 8, 1899.

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Motor Starting Rheostats.
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Special Rheostats.

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Westfield, N. J., U. S. A.

WANTED.

ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.

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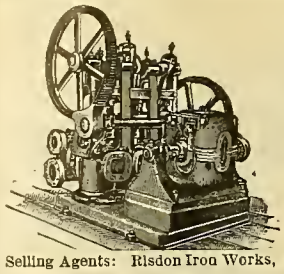

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OPERATED BY ELECTRIC MOTOR.

SINGLE AND DOUBLE ACTING.

HOUSE PUMPS, ELEVATOR PUMPS,
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Pumping Machinery for Every Possible Duty New Catalogue Free.

Manufactured by

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BURNED OUT INCANDESCENT LAMPS AND BASES.

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Automatic Motor Starters. Overload Motor Starters.
Automatic Pump Starters.
Belted Elevator Starters.
Automatic Speed Regulators.

THE CHICAGO RHEOSTAT CO., 19 South Jefferson Street, Chicago.

Scrap Copper Wire Wanted.

If you have any **Old Copper Wire** of any description to dispose of, it will pay you to communicate with us, as we are at all times in the market for any quantity of **Scrap Copper Wire**, at the highest market values. We pay cash and send prompt returns. We are also supplying the electrical trade with our high grade **Babbitt, Cotton Waste, Solder, Etc.** Please communicate with us.

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BARGAINS IN DYNAMOS, ENGINES.

Write for Price List No. 22.

Direct Current Dynamos, Alternating Current Dynamos, Arc Dynamos, Engines, Boilers, Heaters, Pumps, all sizes. This apparatus has been in use in our own stations, and we therefore know its exact history, and can state that it is in thoroughly good operative condition.

CHICAGO EDISON COMPANY, 139 ADAMS ST., CHICAGO.

"AS GOOD AS NEW."

RAILWAY GENERATORS.

Two m. p. 8-400-100 General Electric for direct connection.
Two m. p. 4-300-400 General Electric, with instruments.
One 150 k. w. multipolar Walker.
Two 300 k. w. four-pole Westinghouse.
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Lot of G. E. 800, 3 and 4 turo, drum armature type, practically new, very cheap.
Lot of No. 3 Westingbouse, 25 h. p., first-class condition, very cheap.
Lot of W. P. 50's, good condition.
Extra armatures for all the above.

ALTERNATORS.

One 45 k. w. Westinghouse, 2,000 volts, 7,200 alternations, toothed armature with exciter and instruments.
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One 45 k. w. Westinghouse, 1,000 volts, 16,000 alternations, toothed armature.
Two 30 k. w. Westinghouse, 1,000 volts, 16,000 alternations, toothed armature, with exciters.
Two A 120 k. w. General Electric, 1,000 volts, 16,000 alternations, toothed armature, with exciters and instruments.
One A 90 General Electric, 1,000 volts, with exciter and instruments, practically new; very cheap.
Two A 70 T.-H., 1,000 volts, 16,000 alternations, with exciters and instruments.

DIRECT-CURRENT DYNAMOS.

(110 Volts.)

Two 12 k. w. Edison bipolar, compound wound.
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Two 45 k. w. Edison bipolar.
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(500 Volts.)

One 50 h. p. Thomson-Houston, D-50.
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One 40 h. p. Westinghouse multipolar, 950 r. p. m.

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We have on hand a large stock of T.-H. and Brush, double and single, 2,000 and 1,200 c. p., and would particularly mention some of the preseot type No. 31 Brush that are as good as new.

ARC DYNAMOS.

Two 60-light Ft. Wayne, 2,000 c. p.
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Two 30-light 2,000 c. p. T.-H.
Two 30-light c. p. Brush.
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Two No. 8 65-light 2,000 c. p. Brush.
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ENGINES.

13 in. x 13 in. A. & S.
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14 in. x 16 in. N. Y. Safety.
16 in. x 32 in. Greene.

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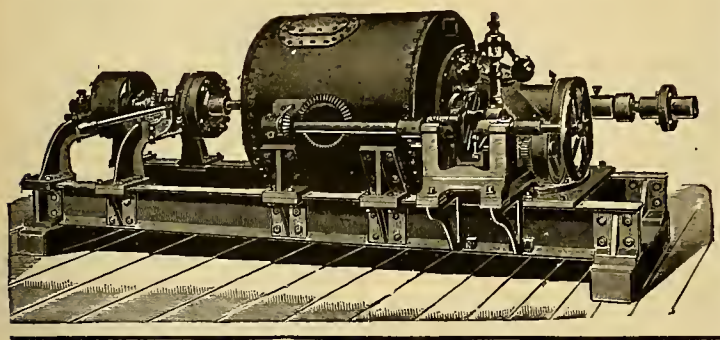

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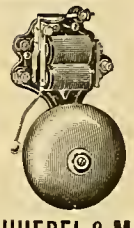

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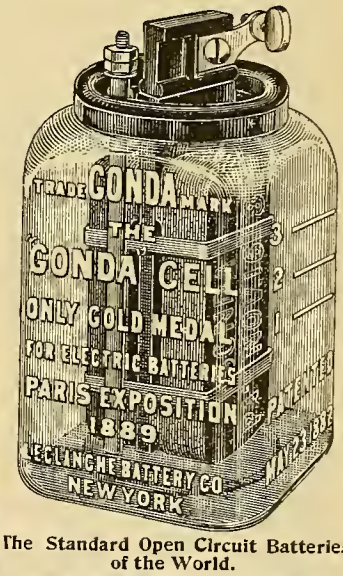

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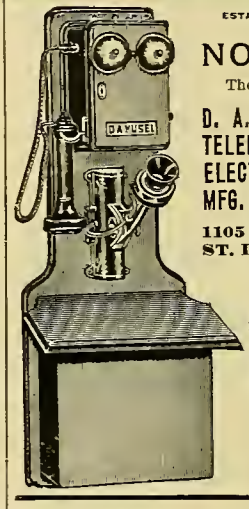

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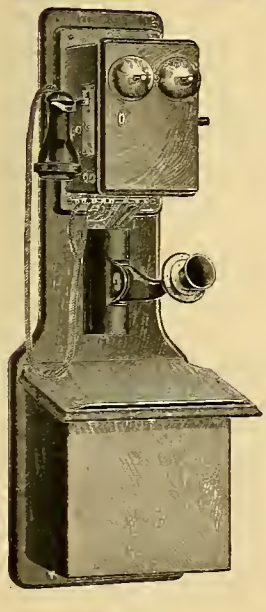

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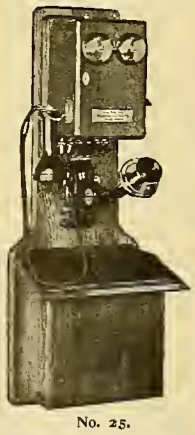

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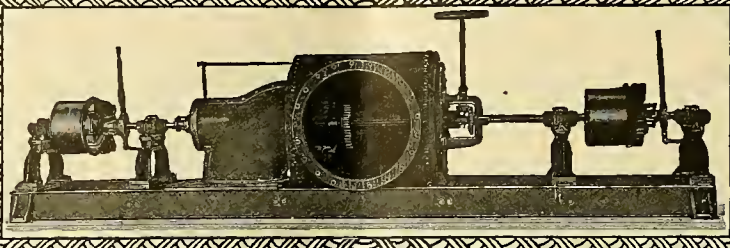

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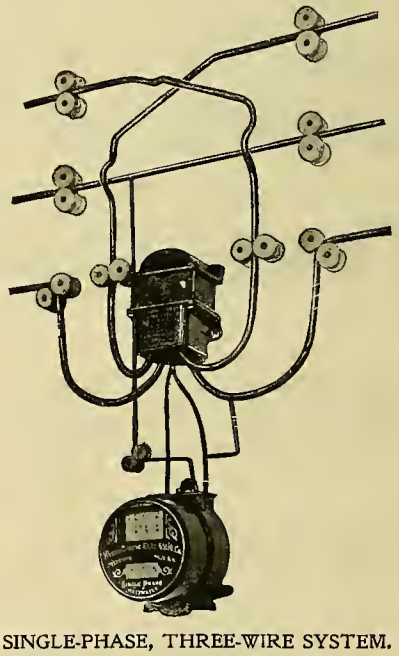
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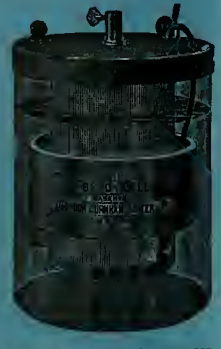

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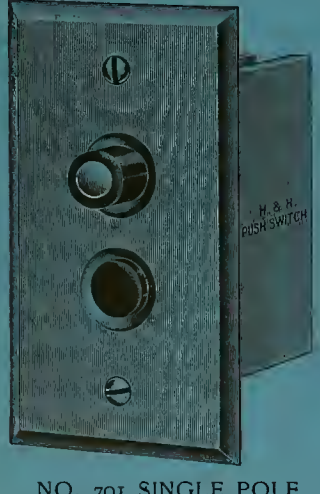

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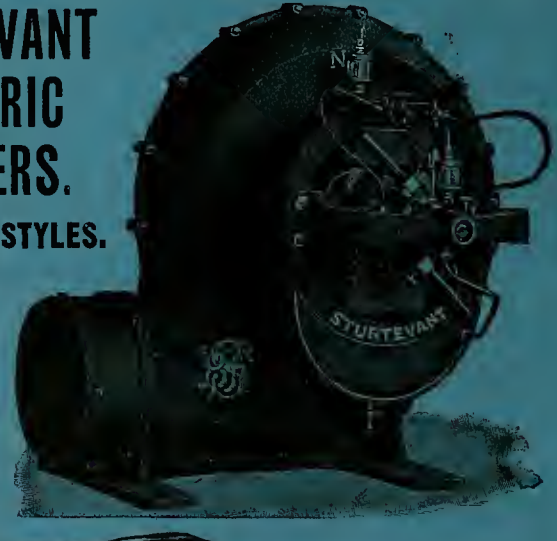

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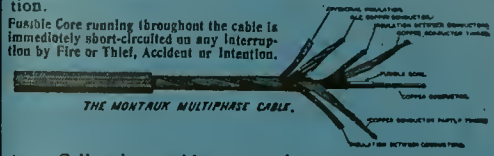

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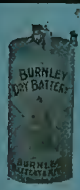

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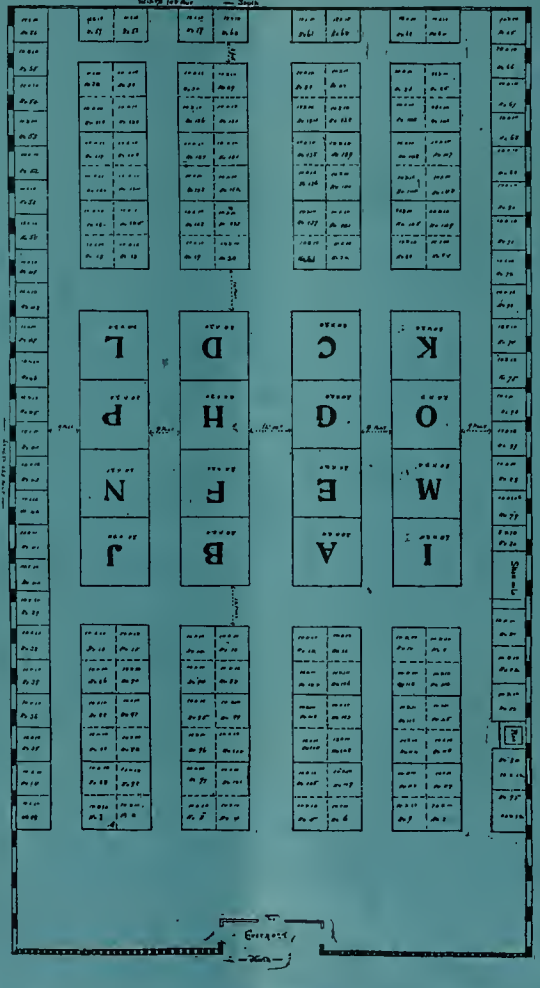

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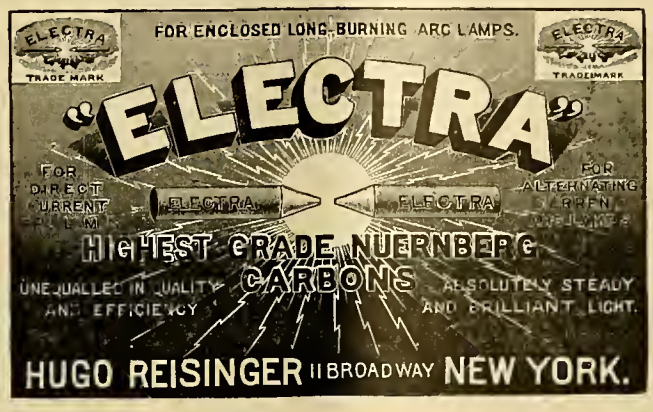

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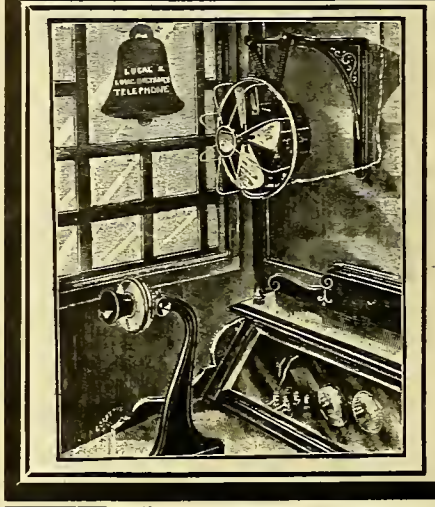

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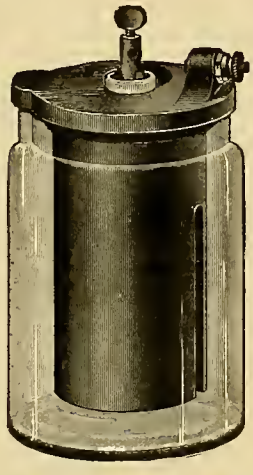

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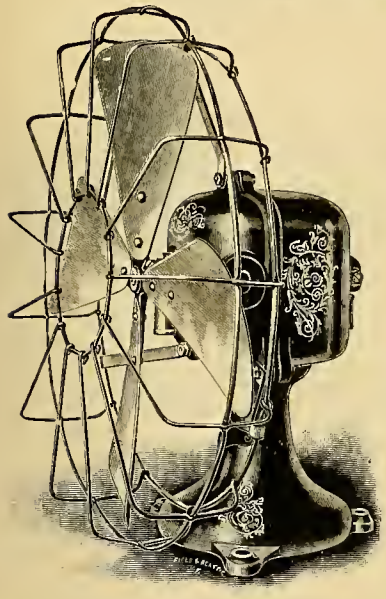

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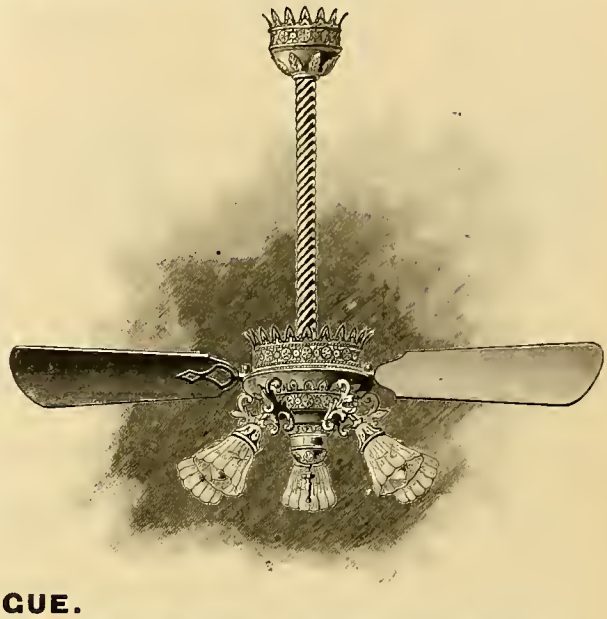

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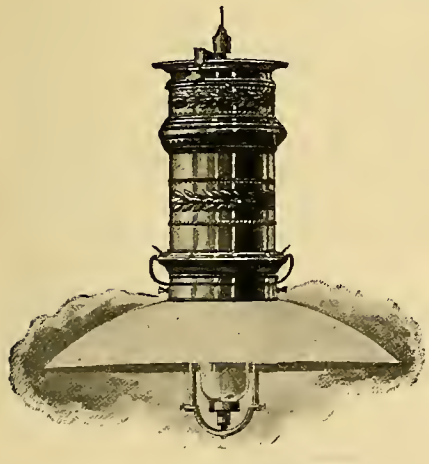

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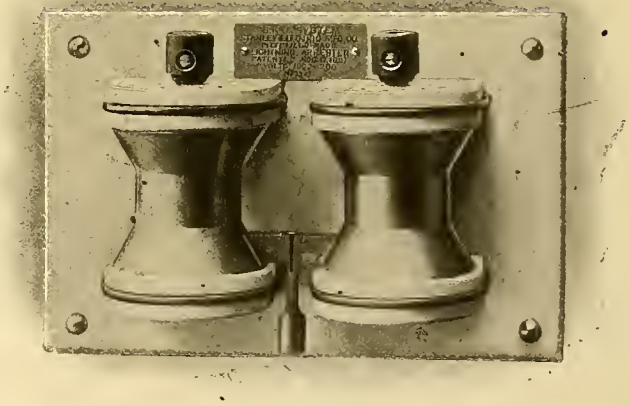

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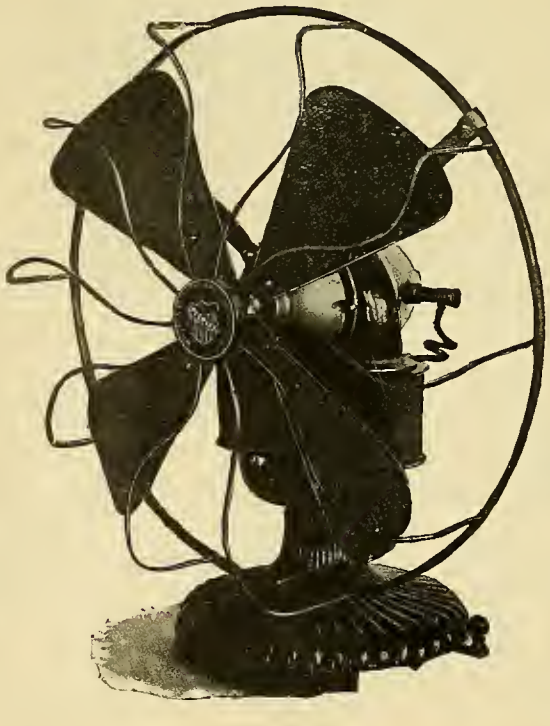

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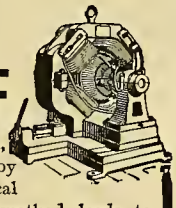

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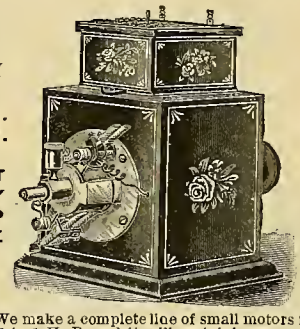

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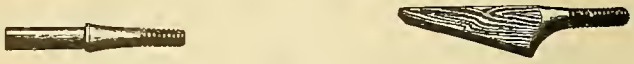

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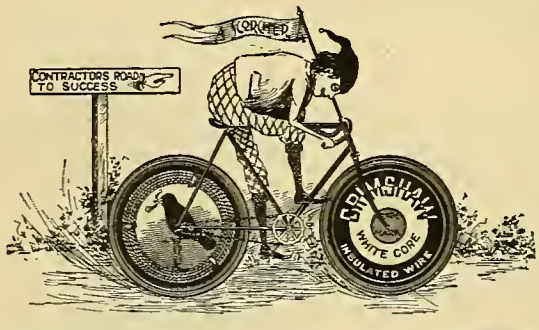

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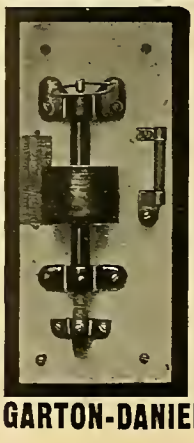

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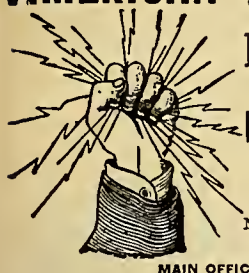

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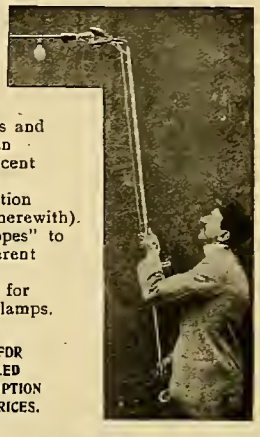

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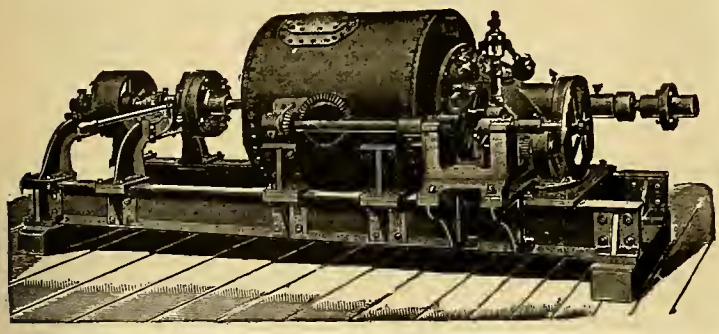

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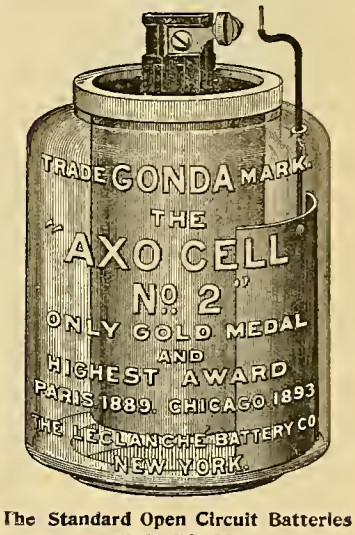

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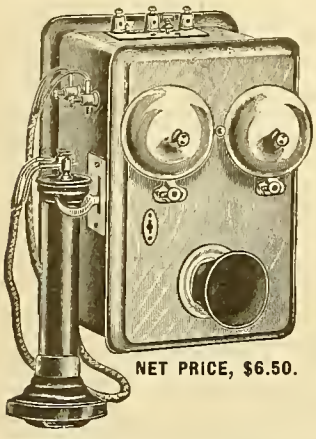
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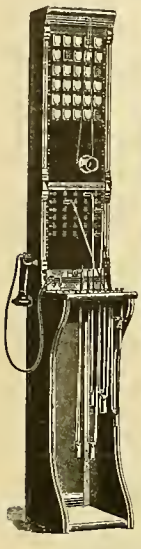

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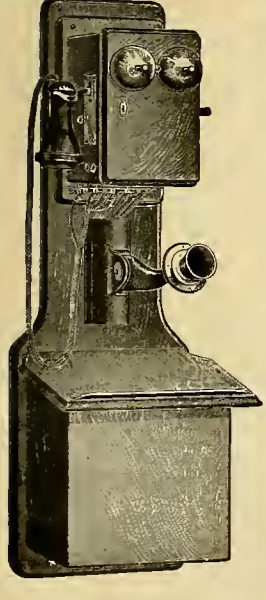

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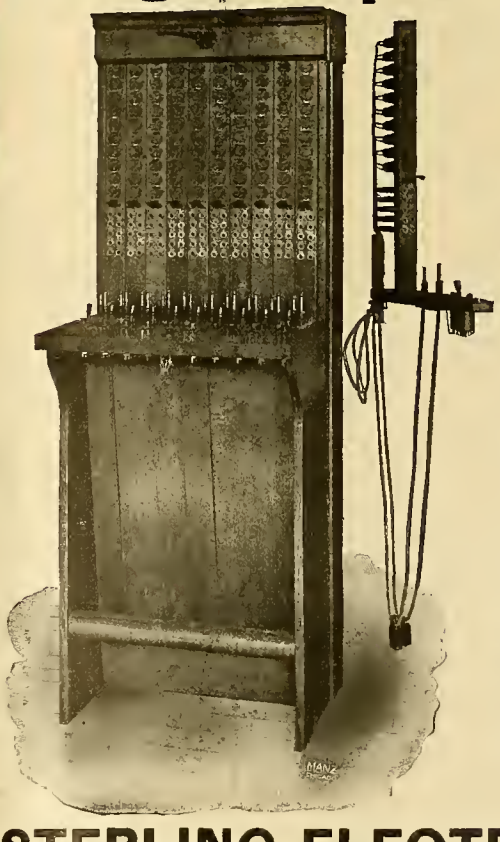

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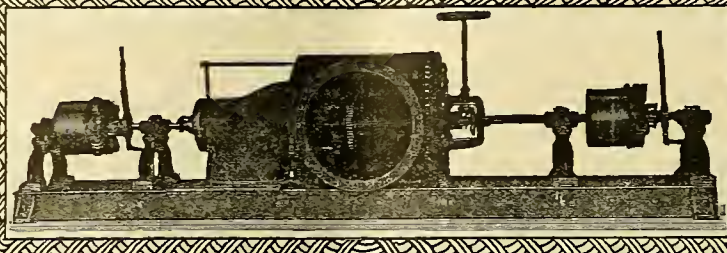

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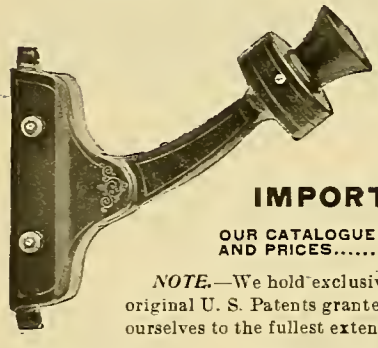

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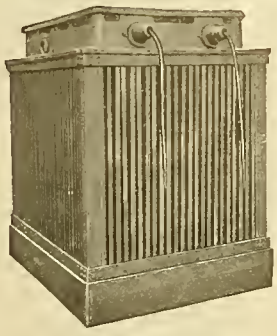

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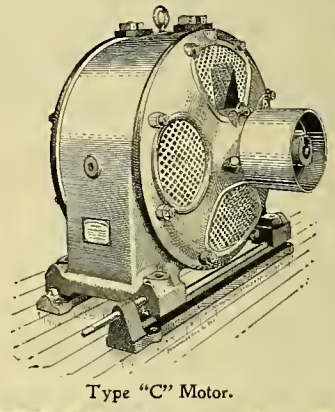

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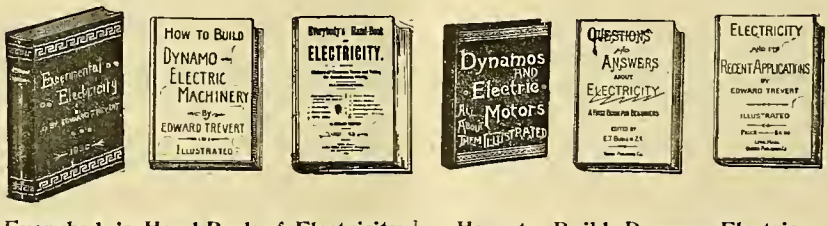

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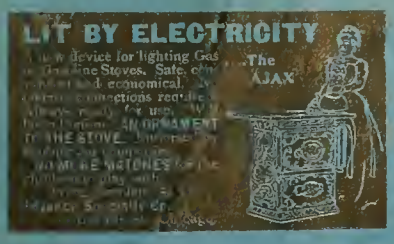

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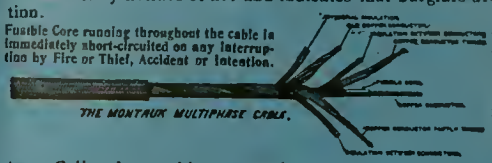

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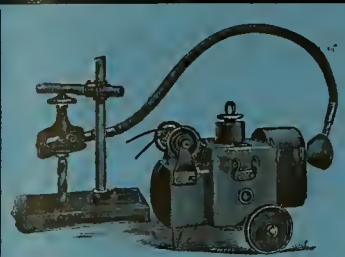

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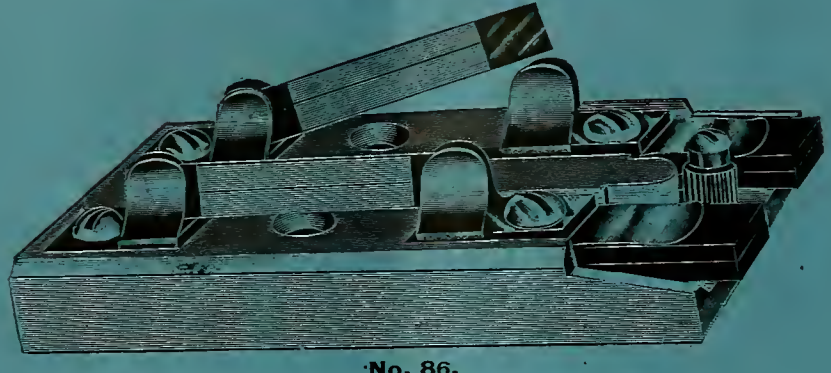

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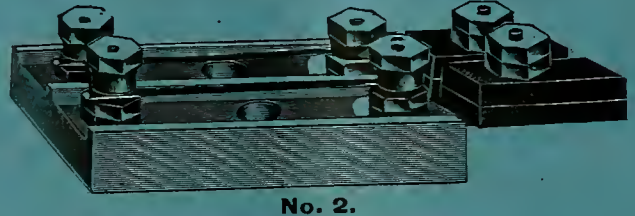

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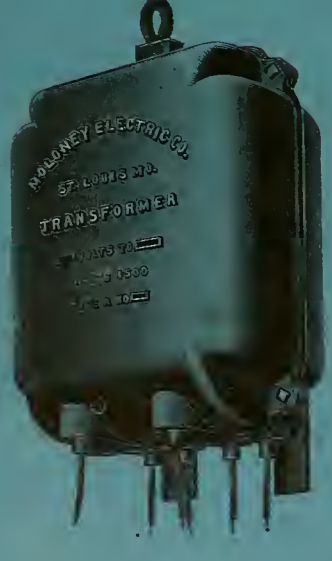

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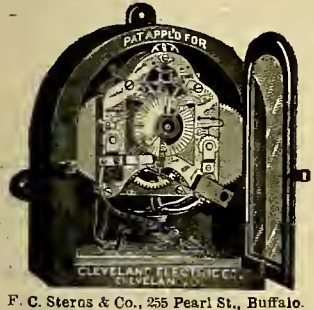

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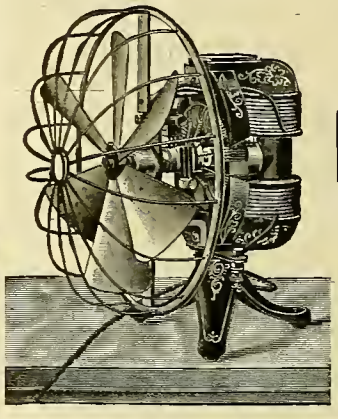
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The only efficient battery fan outfits on the market. Invalnable for the sick room.

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If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

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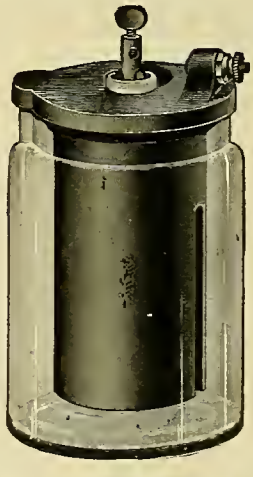

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50 IN A BBL.

Are all kept to the highest standard of quality, but the price is cut way down to 18c.

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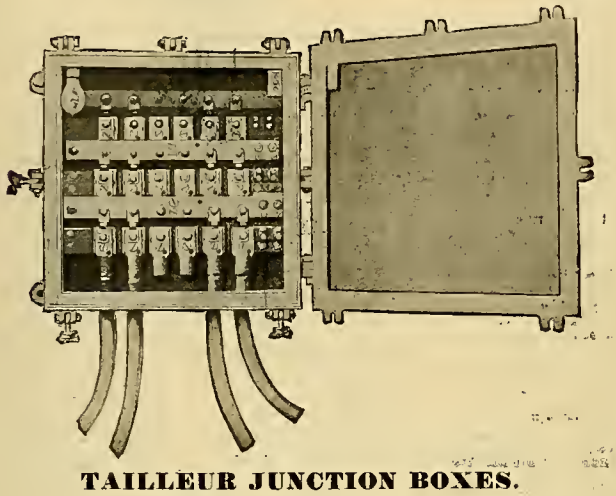
G. I.

UNDERGROUND MATERIAL.



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G. I.

Underground Material is fully described in Bulletin No. 35, mailed on application.

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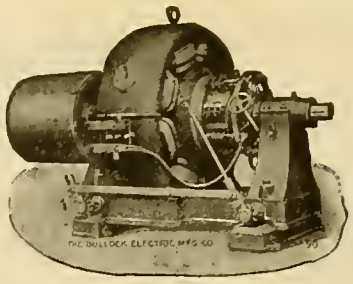
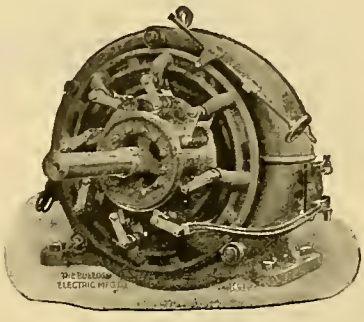
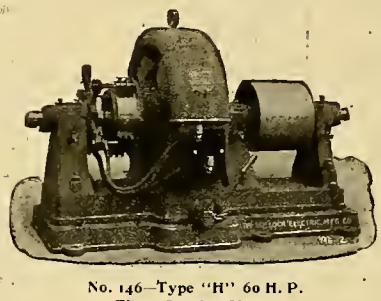


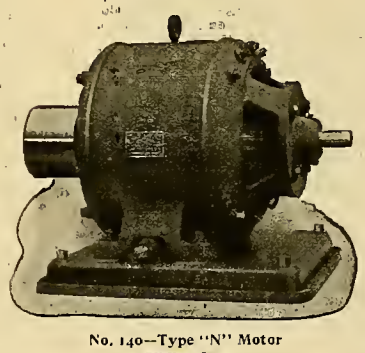
No. 90—Type "H" 200 K. W. Belted Generator.



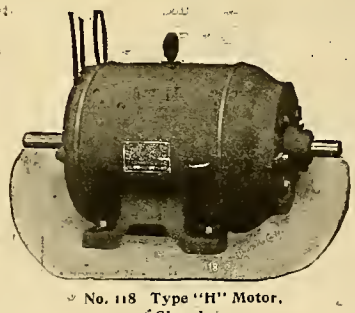
No. 144—Type "A" 150 K. W. Engine Type Generator.



No. 146—Type "H" 60 H. P. Three-Bearing Motor.



No. 140—Type "N" Motor on Sliding Base.



No. 118 Type "H" Motor, Closed.

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ARC LAMP.

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IN MAGNETIC
BALANCE.

NO FRAME WORK VISIBLE.

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Practically Silent on 16,000 Alternations.

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ARC
LAMP.

SEND FOR
"PETITE ALTERNATING"
CATALOGUE.

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CHICAGO. NEW YORK.

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WHICH ARE EFFICIENT. . . . . .
WHICH ARE WONDERFULLY SIMPLE.

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The Mahoning Electric Light Co. The Youngstown Electric Light Co.
LIGHT, HEAT, POWER, AND ELECTRICAL CONSTRUCTION
112 WICK AVENUE.

YOUNGSTOWN, OHIO, June 19th, 1899.

Wagner Electric Mfg. Co.,
2017 Locust St.,
St. Louis, Mo.

Gentlemen:--

Replying to yours of a recent date regarding the operation of your single phase induction motors on our lines, we may say that our silence is satisfaction.

The Motors have given absolutely no trouble, and have required no particular attention on our part.

The minimum cost, and convenience of installation on ordinary single phase lighting circuits, fed by a common transformer system, is to be commended.

Yours truly,
THE YOUNGSTOWN ELECTRIC LIGHT CO.,
J. H. Perkins
Ass't Gen'l Manager.

ALSO GET OUR BULLETIN No. 26, ON THIS SAME SUBJECT. . . . . .

WRITE FOR COPY OF A VERY FULL DISCUSSION OF THE SUBJECT OF "THE SINGLE-PHASE MOTOR," PRESENTED TO THE STUDENTS OF ONE OF OUR LEADING TECHNICAL SCHOOLS IN LECTURE FORM, WHICH WE ARE JUST ISSUING IN PAMPHLET FORM. . . . .

WAGNER ELECTRIC MFG. CO.,
ST. LOUIS, U. S. A.

BRANCH OFFICES:
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NEW YORK, . . . 203 Havemeyer Bldg.
PHILADELPHIA, . . 1000 Betz Building.
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SAN FRANCISCO, . . 404 Market Street.

THE UNITED ELECTRIC IMPROVEMENT CO.

Office and Works: 19th and Allegheny Avenue,
PHILADELPHIA, PA.

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Direct and Alternating Current Apparatus for Lighting and Transmission of Power.

High-Grade Incandescent Lamps
FOR ANY SERVICE.

SEND FOR SAMPLES OF OUR NEW SERIES LAMPS.

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Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

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We make a specialty of apparatus for the transmission of Electrical Power through factory or other buildings.

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SAN FRANCISCO, CAL., California Elec. Works, 409 Market St.
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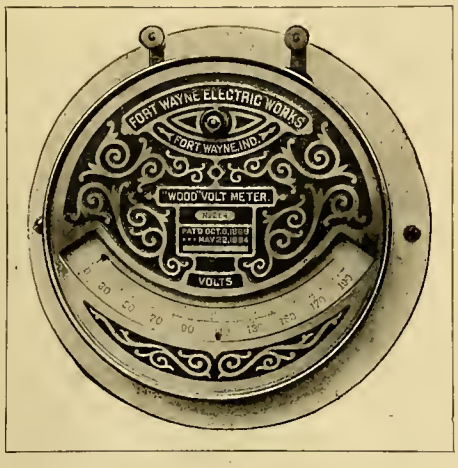
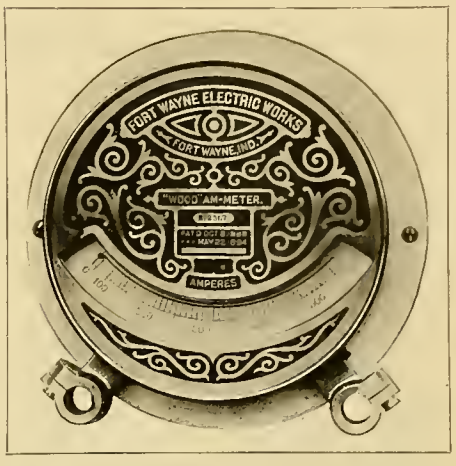
(INCORPORATED)



"WOOD"

VOLT AND AMPERE METERS ARE ALWAYS ACCURATE.



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and promoted under business conditions. Patents quickly sold.

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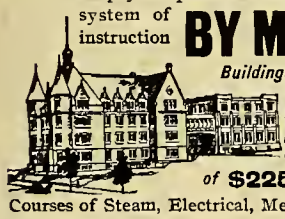
EDUCATION

Thousands have been helped to better pay and positions through our system of instruction **BY MAIL**



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$2 a Month pays for a College Education at Home.

45,000 Students and Graduates.

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—MANUFACTURERS OF—

STEEL OUTLET AND JUNCTION BOXES, SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.

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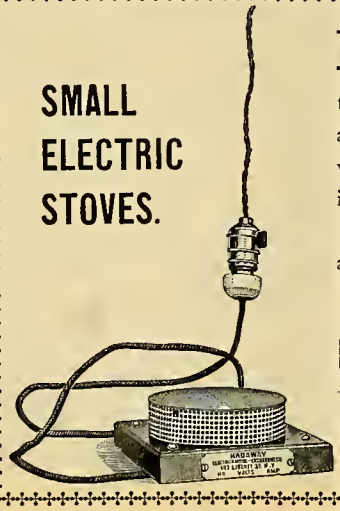
Rubber Wire and Cables.

SMALL ELECTRIC STOVES.



IN the development of electric heating apparatus for industrial work, we have brought out a small stove 4¾ inches diameter, which is a marked improvement in this line.

Let us send you description and prices.

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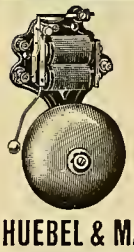
A new device for lighting Gas or Gas line Stoves. Safe, convenient and economical. No electric connections required. Always ready for use. Will last a lifetime. AN ORNAMENT TO THE STOVE. Endorsed by leading gas companies. NO MORE MATCHES for the children to play with. Price, complete, $2.50. Advance Specialty Co., 113 LaSalle St., Chicago.



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VIA THE

MONON ROUTE

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Composed of simply a magnet and needle. No intermediate mechanism between needle and armature. Adjustment seldom necessary, yet easily made. In oak finish only; sizes 4 to 16 indications.

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Water and Hydraulics.
NOTHING
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INDIA & AMBER
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IN ANY SHAPE OR PATTERN.
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PERFECT MICANITE INSULATOR
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WRITE FOR SAMPLES AND PRICES.

Sterling Extra Insulating Varnish.
THE STERLING VARNISH COMPANY, 325 Water St., Pittsburg, Pa.

A COMMUTATOR NECESSITY!

50 CENTS PER STICK. $5.00 PER DOZEN.
Upon Receipt of this COUPON we will Send FREE, Sample Stick.

Name .....
Address .....
W. E.

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
ABSOLUTELY WILL NOT GUM THE BRUSHES. . . .
It will put that high gloss on the commutator you have so long sought after.
For Sale by all Supply Houses, or
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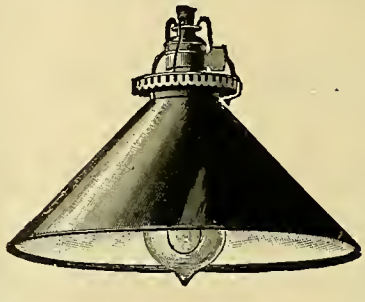

Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

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INCANDESCENT LAMPS.
QUALITY UNEQUALED.
FACTORY PRODUCTION TRIPLED.
Monadnock Building, Chicago.
THE BUCKEYE ELECTRIC CO., Cleveland, Ohio.

Your T.-H. arc lamps ARE NOT COMPLETE unless they are equipped with the

Knutson Gravity Clutch,

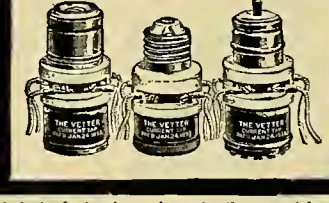
Acknowledged by the leading electric light plants to be

THE CLUTCH.

Send for a sample and put it in "that lamp over there" that has been giving you so much trouble, and let us prove to you that this is **no fake.** There are thousands already in use. Of course you think the various kinds of clutches you are now using are allright, but just wait till you have tried ours; that is all we want you to do. They are the **CHEAPEST** and the **BEST.**

A. W. KNUTSON & CO., Galesburg, Ill.

The Vetter Current Tap.
A Tapping Plug and Lamp Socket Combined.



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Send For Descriptive Circular and Discount Sheet.

A simple and safe device for tapping and carrying the current from any electric light fixture to Motors, Drop-lights and other electrical devices WITHOUT THE LOSS OF LAMP IN FIXTURE. Adapted to any system of electric lighting. When ordering, state what socket is used. Each tap is packed, with full directions, in a neat box.

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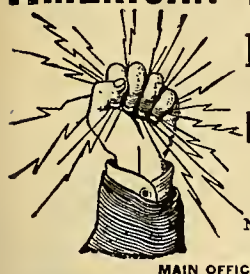

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Railway Feeder and Trolley Wire,
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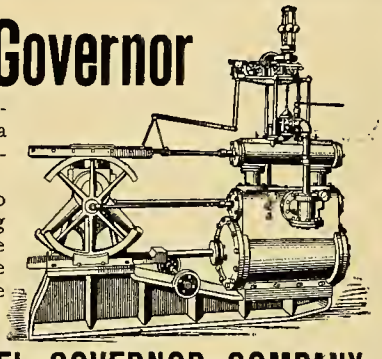
Water-Wheel Governor



Regulates the turbines used on electric railway load in the Niagara Falls Hydraulic Power & Manufacturing Company's plant.

We build governors adapted to all makes of water-wheels, working under all conditions. 70,000 horse power in use. We guarantee the best speed regulation which can be obtained under any conditions.

Address
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OUR WHOLE ATTENTION Is given to the designing and manufacturing of high-class Rheostats. We have no side lines—nothing to distract our attention from this important work.

THE CUTLER-HAMMER MFG. CO.,
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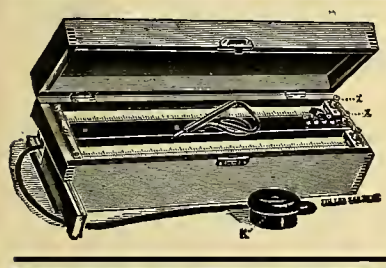
2,000 Rheostats always in stock from which immediate shipments of any size order can be made.



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WILL ACCURATELY MEASURE RESISTANCE ON A RAPIDLY MOVING ELECTRIC CAR.

No other instrument can meet such difficulties of stray magnetism and vibration.

A boy can use it. The brains are in the box.

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Six years with General Electric Co.

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Consultations, Reports, Estimates, Plans, Specifications, Superintendence, Tests, Purchasing. Designs of Central Stations a Specialty.
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Offers every advantage to students wishing to do special work in Electrical Engineering; besides the regular course leading up to the degree of Bachelor of Science in Electricity, it has a special department for those students desiring to get a practical knowledge only in this branch. Catalogues on application. Address
REV. A. MORRISSEY, C. S. C., President

Transformers,
Kuhlman Electric Co.
ELKHART, INDIANA.

FORGET SPAIN, BUT REMEMBER
That we pay spot cash for
BURNED-OUT INCANDESCENT LAMPS

And offer $1 00 and freight charges per hundred for old LAMP BASES of any make except the Edison General Electric Company's, for which we pay 50 cents per hundred. We also buy and pay the highest market prices for Platinum, Brass and Copper Scrap and metals of every description. Special prices paid for series lamps and bases. We will exchange new or renewed lamps for burned-out ones if desired. For full particulars address

AGENTS WANTED. GEO. F. SCHWALM & CO., Harrison, N. J.

Our NEW IMPROVED BATTERY keeps the
American Electric Vehicle Co.
IN THE LEAD—PIONEERS ALWAYS
Send for Catalogue of Carriages
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PROMPT SHIPMENTS OF
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THE EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO.

American Electrical Heater Company,
MANUFACTURERS OF

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2,000 LIGHTS.

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IT WILL PAY YOU

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WEATHERPROOF WIRE.

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

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Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.

WANTED.

A competent man as foreman to take charge of department manufacturing switchboards and switches, etc. State experience and salary expected. Address "SWITCHBOARD," care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

Position Wanted.

Young man, electro-technical graduate, desires position with light or railway company; prefers position as assistant engineer or electrician; at present running small alternating-light plant. Good reasons for desiring change; references furnished. Address "W. D.," care Western Electrician, 510 Marquette Building, Chicago, Ill.

Notice to Contractors.

Sealed proposals for furnishing the material and performing all the necessary work of construction of a system of commercial electric lighting in the Village of Western Springs, Cook County, Illinois, in accordance with the plans and specifications on file in the office of the Village Clerk at Western Springs (copies of which specifications may be had upon application).

Same will be received by said Village Clerk until 8 o'clock p. m., August 7th, 1899.

Each proposal must be accompanied by a certified check for $250.

An approved bond in the sum of $2,500 to be entered into by the contractor whose bid may be accepted.

Payments to be made as work progresses.

The right is reserved by the Board of Trustees to reject any or all bids.

Western Springs, Ill., July 25th, 1899.

R. L. McCLELLAND,
Village Clerk.

PROPOSALS WANTED

For Steam and Electric Machinery for Municipal Electric Lighting Plant, City of Monroe, Mich., Sealed proposals will be received at the office of the City Clerk of the City of Monroe, Mich., until 8 o'clock p. m., on the 12th day of August, 1899 (at which time said proposals will be opened), for the furnishing of all labor and materials for the construction of the necessary building, engines, dynamos, lamps, pole lines, etc., for an electric-lighting plant for said city, in accordance with the plans and specifications on file with the City Clerk.

All bids must be addressed: "City Clerk, Monroe, Mich.," and endorsed on outside of the envelope: "Bids for Electric-Lighting Plant" and the divisions of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified check for an amount equal to five per cent. of the total amount of his proposal, payable to the order of the Treasurer of the city of Monroe, Mich., which sum shall be forfeited to said city in case the bidder refuses or neglects to enter into a contract with said city pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council), within five days after he shall have been notified of the acceptance of his bid or proposal. Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and Council of the City of Monroe, Mich., in such sum, not exceeding the amount of his contract, as the Mayor and Council shall determine, conditioned on the full and faithful performance on his part of the contract. Another bond, running to the people of the State of Michigan, will be required, conditioned for the payment of wages earned and material, apparatus and machinery furnished in the performance of the contract. In the proper execution of the contract and bonds the guarantee deposit will be returned to the contractor.

Copies of the specifications can be seen at the office of the City Clerk, or at the office of the city's Engineer, A. S. Van De Mark, Room 12, 82 Griswold Street, Detroit, Mich. All proposals must be made out on blanks provided for that purpose. The Council expressly reserves the right to reject any or all proposals and to waive irregularity in any proposal.

JOHN STEINER,
City Clerk.

Dated at Monroe, Michigan, this twenty-fifth (25th) day of July, 1899.

Wanted to Lease.

Electric Light Plant, by two first-class men in plant operation, engineers, machine and lamp experts; inside and outside wiremen; will improve system. Highest possible recommendations and references. Address "OPERATORS," care Western Electrician Publishing Co., 510 Marquette Bldg., Chicago, Ill.

WANTED.
ARMATURES TO REWIND.
Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.
HOOGE-WALSH ELECTRICAL ENGINEERING CO.
701 Delaware St., KANSAS CITY, MO.

Motor Starting Rheostats.
Motor Regulating Rheostats.
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Theater Dimmers.
Special Rheostats.
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All Kinds.
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WATER WORKS PUMPS, ETC.
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Scrap Copper Wire Wanted.
If you have any **Old Copper Wire** of any description to dispose of, it will pay you to communicate with us, as we are at all times in the market for any quantity of **Scrap Copper Wire**, at the highest market values. We pay cash and send prompt returns. We are also supplying the electrical trade with our high grade **Babbitt, Cotton Waste, Solder, Etc.** Please communicate with us.
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Write for Price List No. 22.
Direct Current Dynamos, Alternating Current Dynamos, Arc Dynamos, Engines, Boilers, Heaters, Pumps, all sizes. This apparatus has been in use in our own stations, and we therefore know its exact history, and can state that it is in thoroughly good operative condition.
CHICAGO EDISON COMPANY, 139 ADAMS ST., CHICAGO.

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ARE THE BEST. Send for descriptive Circular.
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Protection Guaranteed.
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is always interesting. Always contains timely information as well as the latest news. If you are not a regular reader send us your name and address for trial offer. . . . . .
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MANUFACTURERS OF
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Bipolar from 1 kilowatt to 40 kilowatts. Multipolar, 5 kilowatts to 100 kilowatts.
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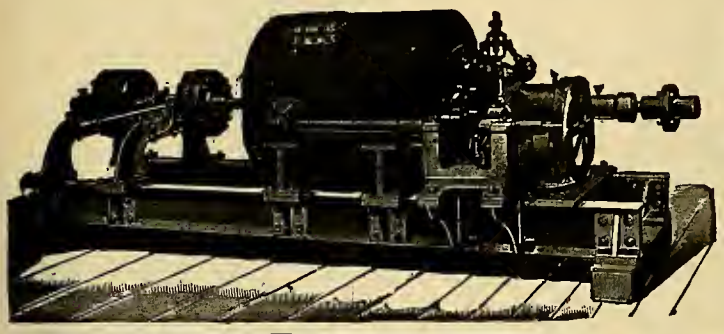
The Perfect Antiseptic Powder.
HEALS BURNS. *Vitogen* MEN, ANIMALS.
Rookery Kennels, Painesville, O., write (June 21): "We made two applications of Vitogen. . . . Underneath the scab removed was a new, soft, healthy skin, free of scar and uniform in color. . . . . **THE SUFFERING** of the dog ended apparently with second application of Vitogen." Every electrician ought to protect himself against serious results from accidental burns, with a bottle of Vitogen. It heals without a scar; relieves pain at once.
Dispensed in perforated screw-cap bottles by druggists, or sent prepaid on receipt of price; 2 oz., 50c.; 4 oz., $1.00. Canadian price, 2 oz., 60c.; 4 oz., $1.20.
Manufacturing Chemists, THE G. F. HARVEY CO., Saratoga Springs, N. Y., U. S. A.
Canadian Branch, Mille Roches, Ont., KEZAR & BENNETT, Agents.

Victor Turbines Operating Dynamos.



That there are more Victor Turbines in use supplying power for electric generators than any other is due to the many points of superiority possessed by this Turbine.

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High Speed, Close Regulation,
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Perfect Cylinder Gate, Steady Motion.

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Eleven Pole Yards in Michigan.
Wholesale Producers for 20 years.

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LINDSLEY BROTHERS COMPANY,
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WHOLESALE PRODUCERS,

POLES

50-foot to 80-foot Poles our Specialty.

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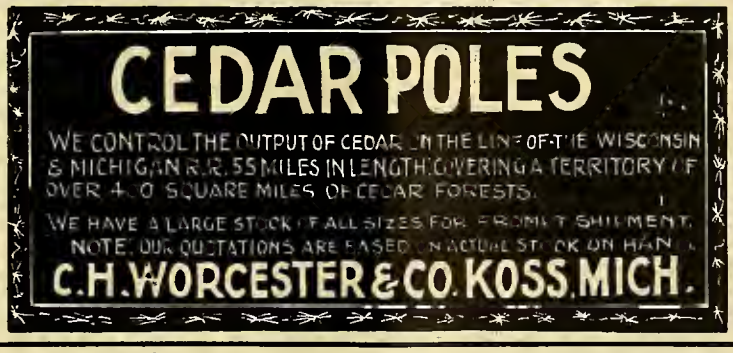

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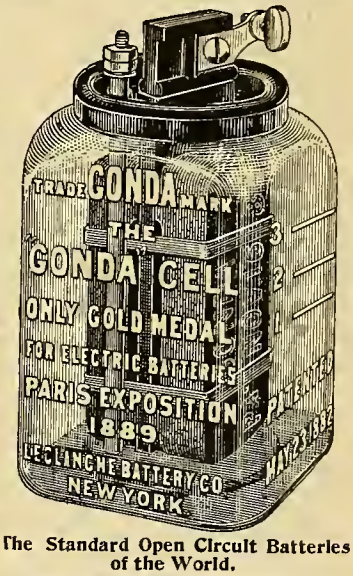

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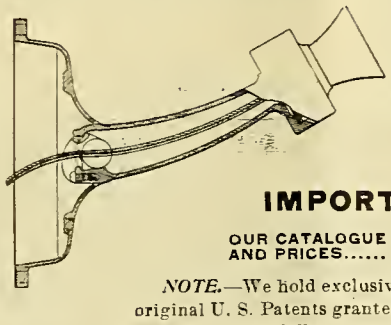

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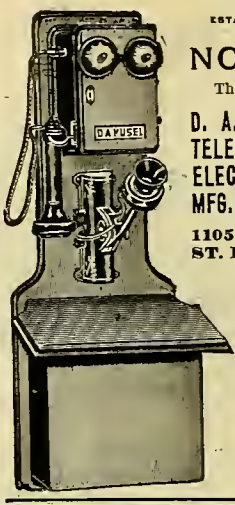

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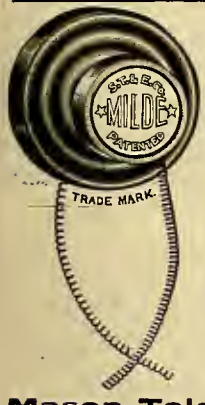

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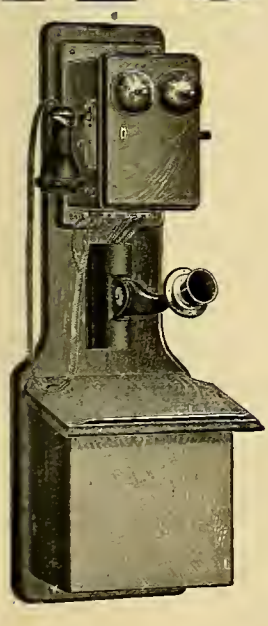

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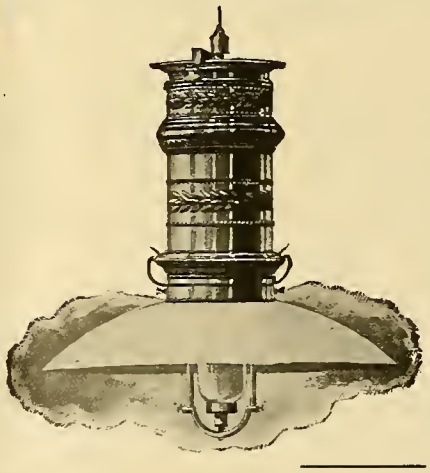

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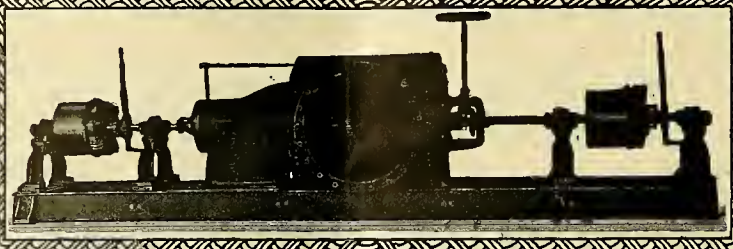

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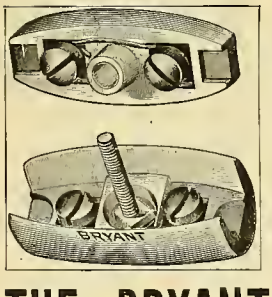

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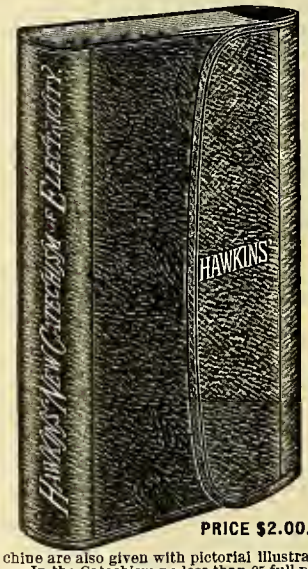

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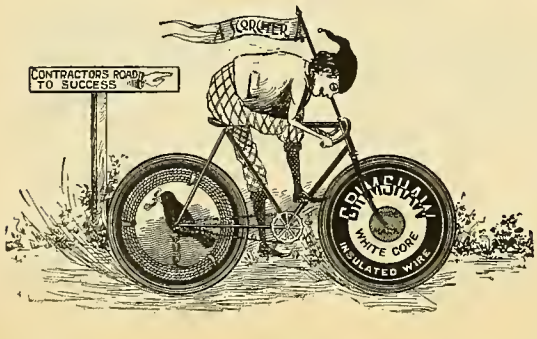

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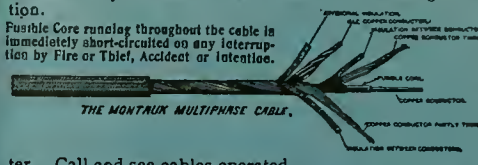

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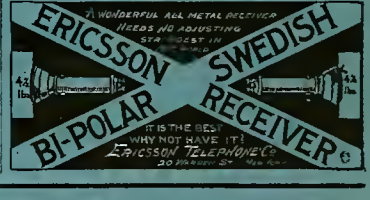

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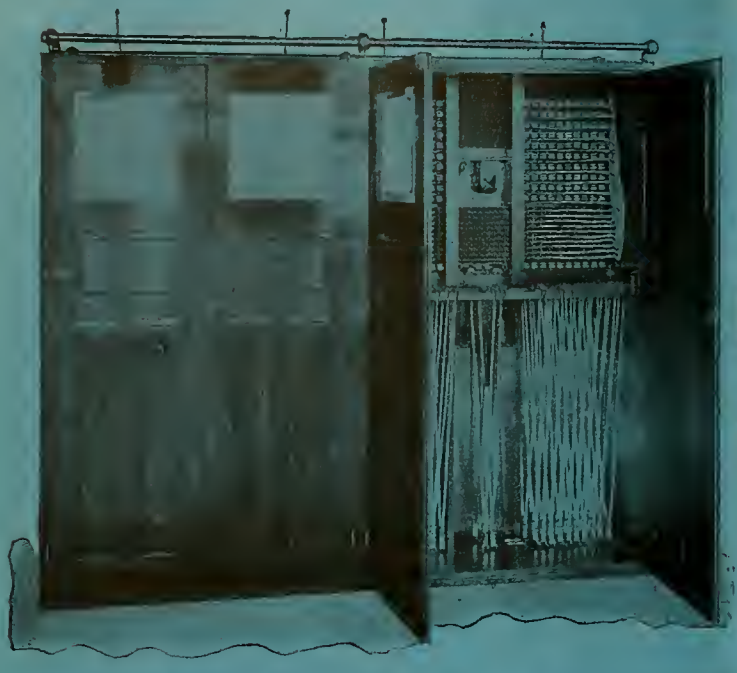

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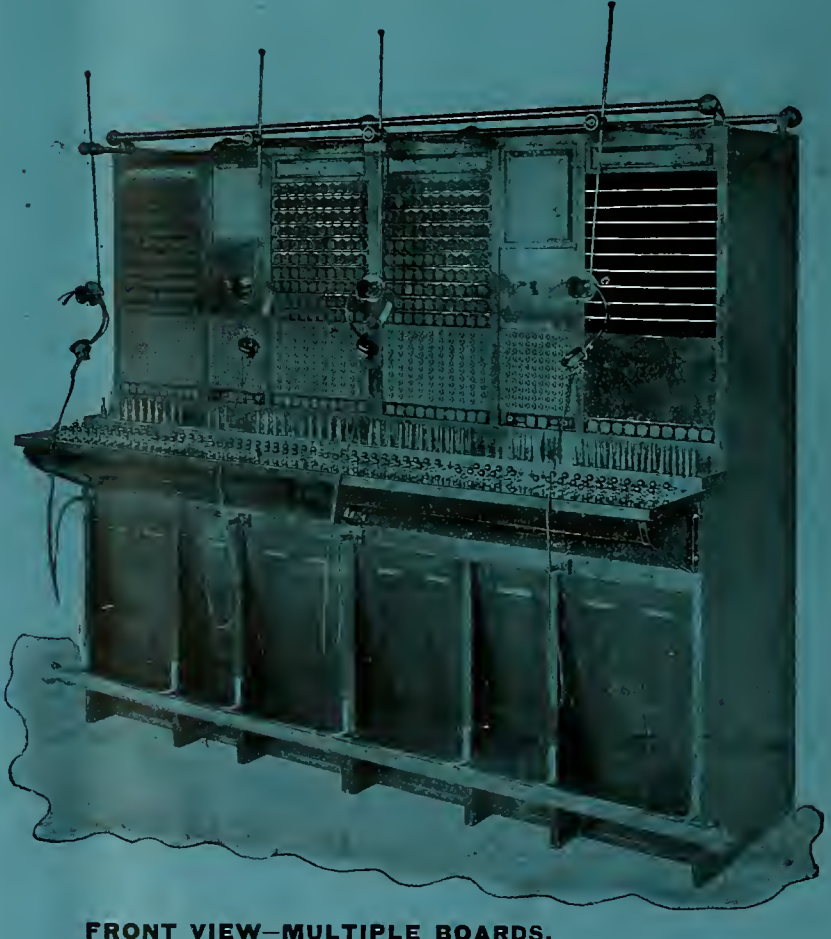

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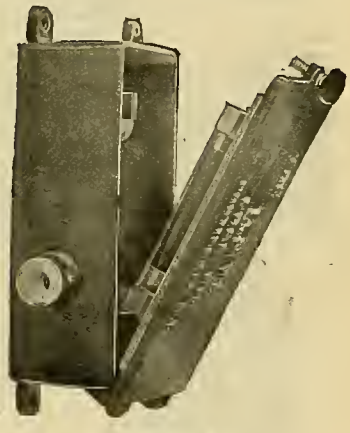

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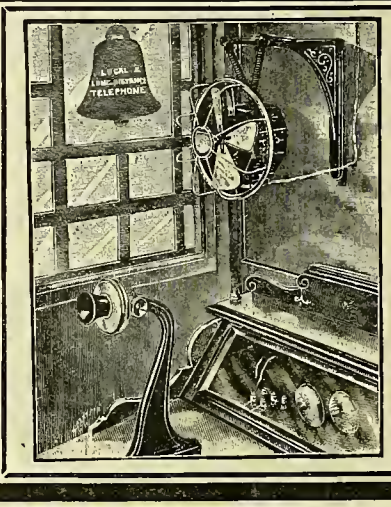

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WE CAN PROVE THAT IT IS THE BEST DRY CELL EXTANT.
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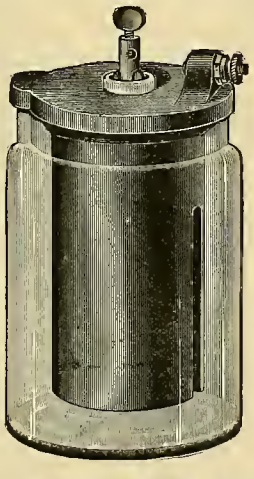

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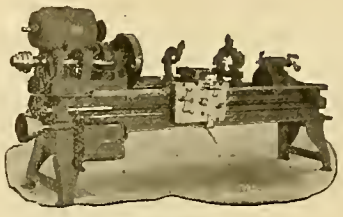
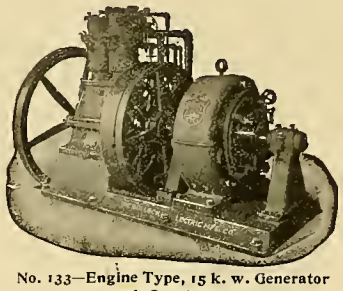
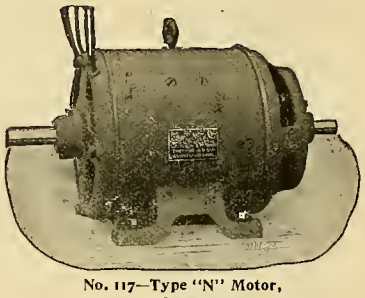
No. 105—Motor in Head-stock of Standard 28-in. Lathe.



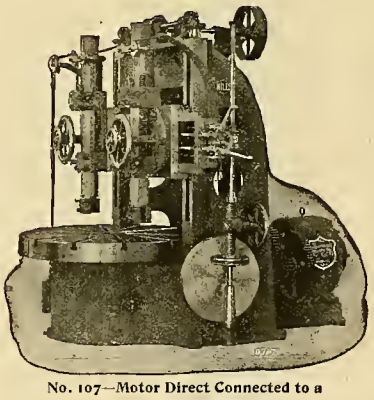
No. 106—Motor Geared to 18-in. Lathe.



No. 133—Engine Type, 15 k. w. Generator with Gas Engine.



No. 117—Type "N" Motor, Open.



No. 107—Motor Direct Connected to a 51-in. Boring Mill.

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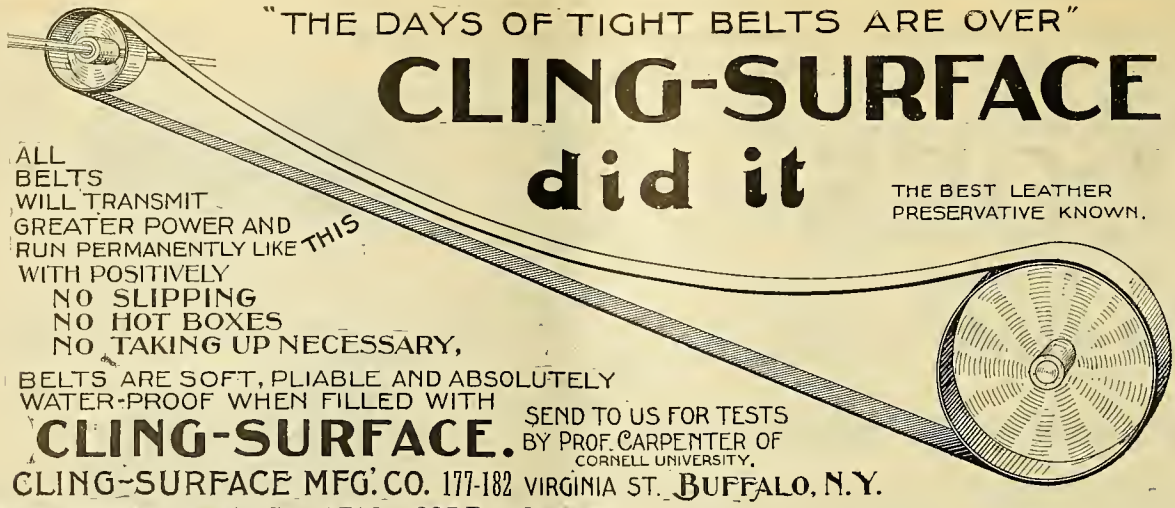

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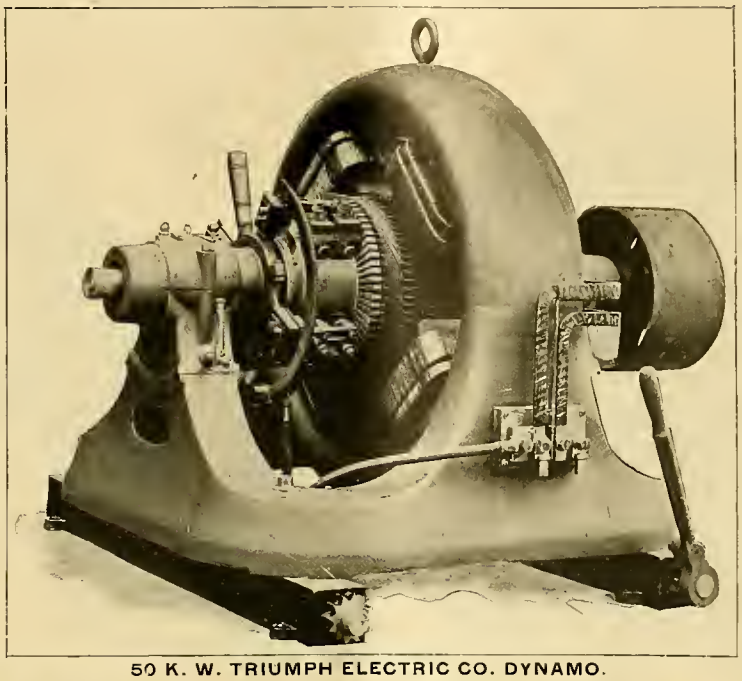

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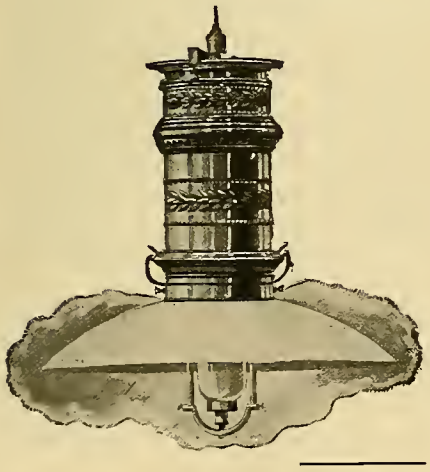
For Constant Potential Circuits are Superior in Points of



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ELEGANCE,
LIGHT.

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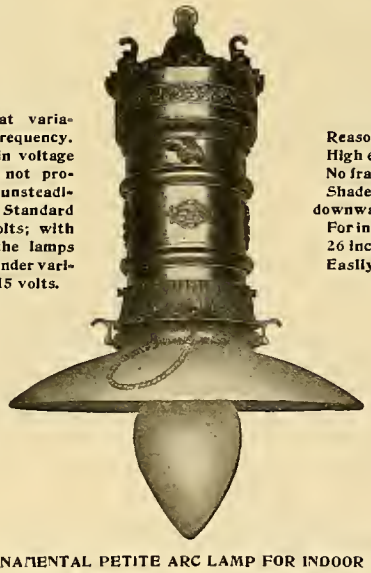

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No framework in sight.
Shade reflects upward rays downward.
For indoor and outdoor use.
26 inches long.
Easily trimmed.

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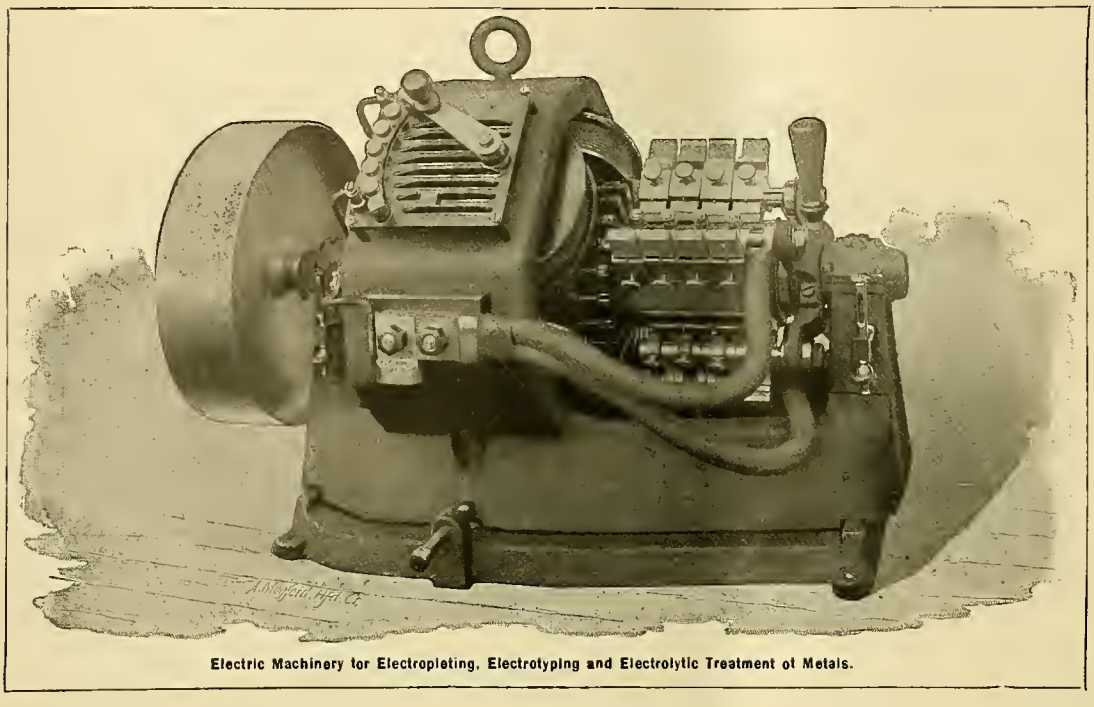

Electric Machinery for Electroplating, Electrotyping and Electrolytic Treatment of Metals.

TYPE G

EDDY MULTIPOLAR ELECTRIC GENERATORS

FOR

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ELECTRIC RAILWAY,
and POWER TRANSMISSION.

MULTIPOLAR STATIONARY MOTORS,

Medium or Slow Speed.

EDDY DIRECT CONNECTED GENERATORS

(TYPE G),

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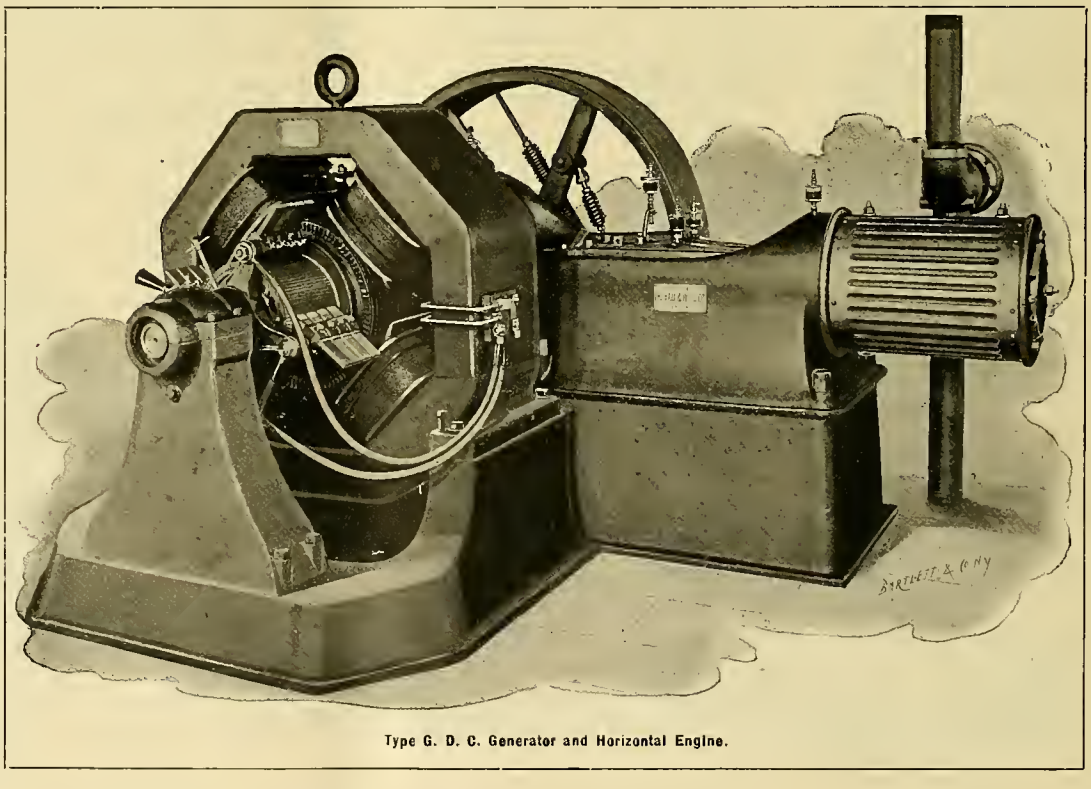

Type G. D. C. Generator and Horizontal Engine.

The EDDY ELECTRIC MFG. CO., Windsor, Conn.

CHICAGO, 837-838 Marquette Building.
NEW YORK, Singer Bldg., 149 Broadway.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
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TRANSFORMER.

Transformer regulation has been perfected in

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Special Connectors for HARD-DRAWN COPPER WIRE, all sizes. FUSED WIRE, FUSED LINKS and STRIPS.

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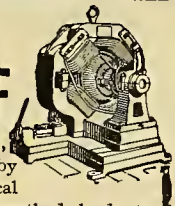

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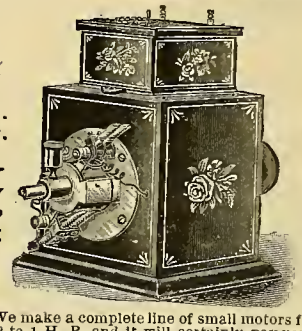

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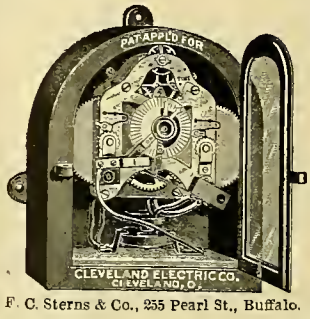

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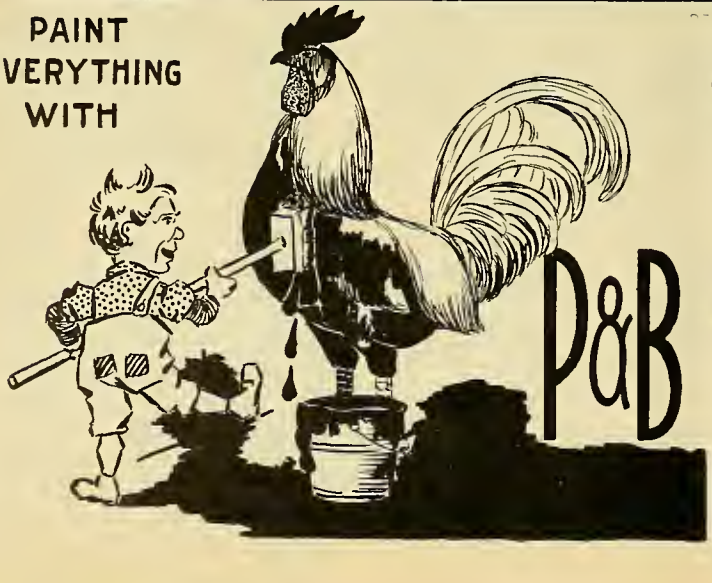

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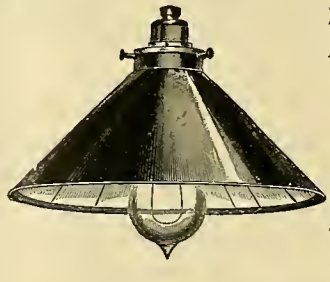

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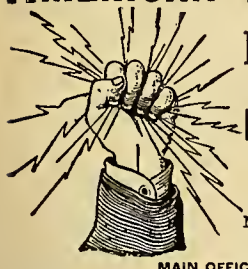

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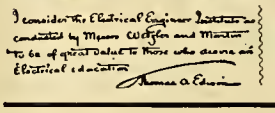

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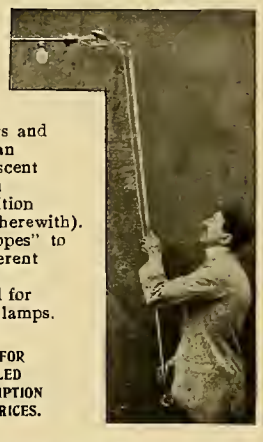

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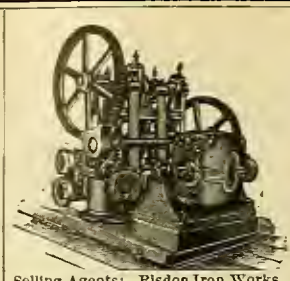

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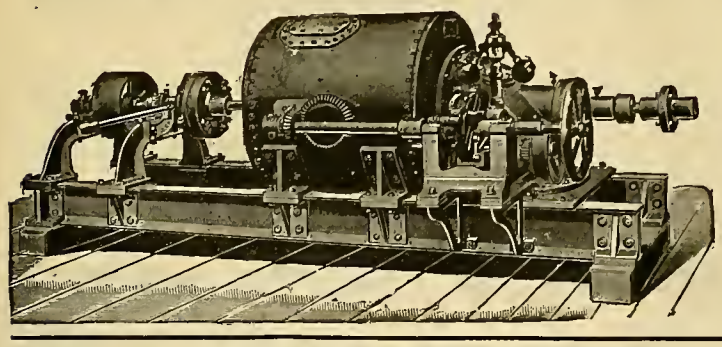

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For Steam and Electric Machinery for Municipal Electric Lighting Plant, City of Monroe, Mich. Sealed proposals will be received at the office of the City Clerk of the City of Monroe, Mich., until 8 o'clock p. m., on the 12th day of August, 1899 (at which time said proposals will be opened), for the furnishing of all labor and materials for the construction of the necessary building, engines, dynamos, lamps, pole lines, etc., for an electric-lighting plant for said city, in accordance with the plans and specifications on file with the City Clerk.

All bids must be addressed: "City Clerk, Monroe, Mich.," and endorsed on outside of the envelope: "Bids for Electric-Lighting Plant" and the divisions of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified check for an amount equal to five per cent. of the total amount of his proposal, payable to the order of the Treasurer of the city of Monroe, Mich., which sum shall be forfeited to said city in case the bidder refuses or neglects to enter into a contract with said city pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council), within five days after he shall have been notified of the acceptance of his bid or proposal. Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and Council of the City of Monroe, Mich., in such sum, not exceeding the amount of his contract, as the Mayor and Council shall determine, conditioned on the full and faithful performance on his part of the contract. Another bond, running to the people of the State of Michigan, will be required, conditioned for the payment of wages earned and material, apparatus and machinery furnished in the performance of the contract. In the proper execution of the contract and bonds the guarantee deposit will be returned to the contractor.

Copies of the specifications can be seen at the office of the City Clerk, or at the office of the city's Engineer, A. S. Van De Mark, Room 12, 82 Griswold Street, Detroit, Mich. All proposals must be made out on blanks provided for that purpose. The Council expressly reserves the right to reject any or all proposals and to waive irregularity in any proposal.

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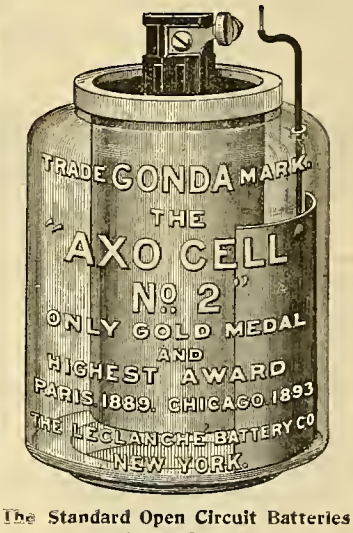

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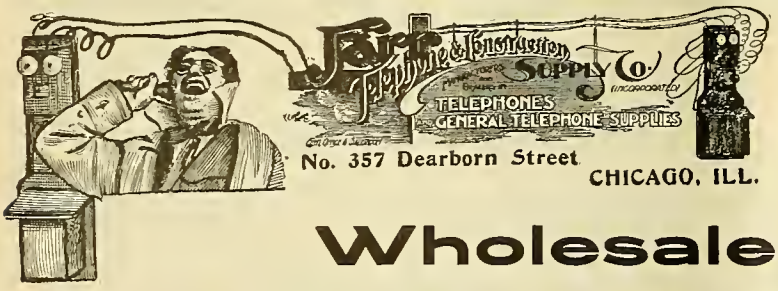

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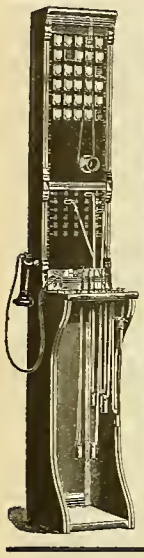

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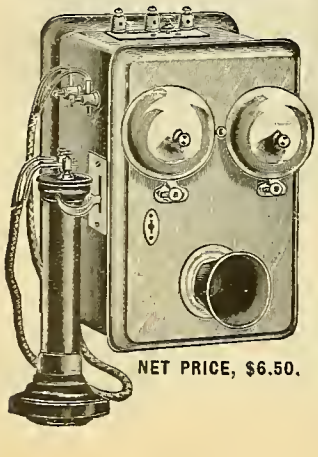

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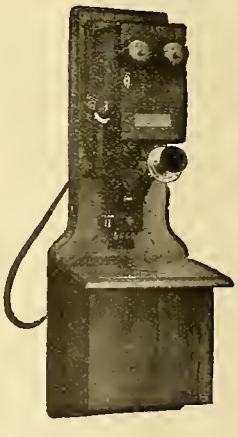

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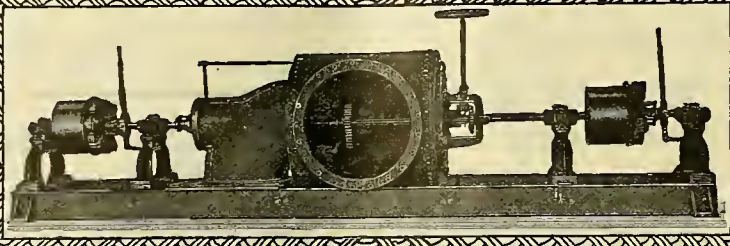

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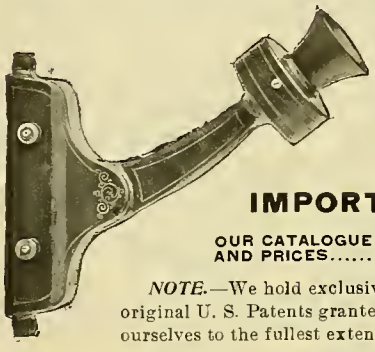

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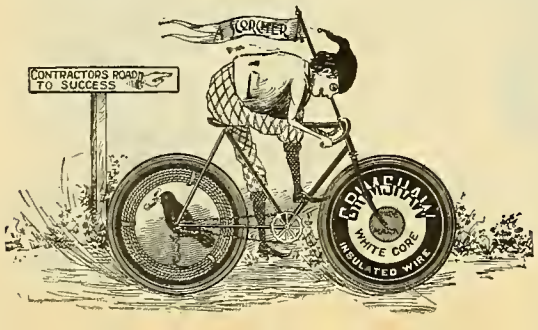

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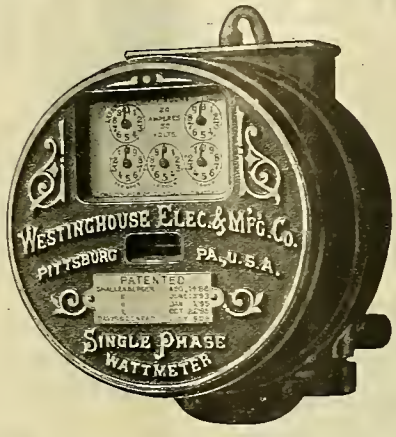

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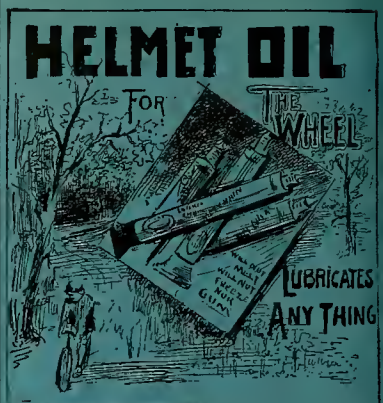

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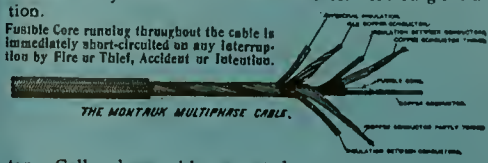

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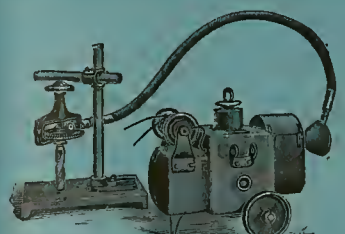

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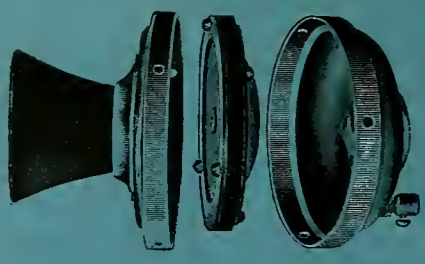

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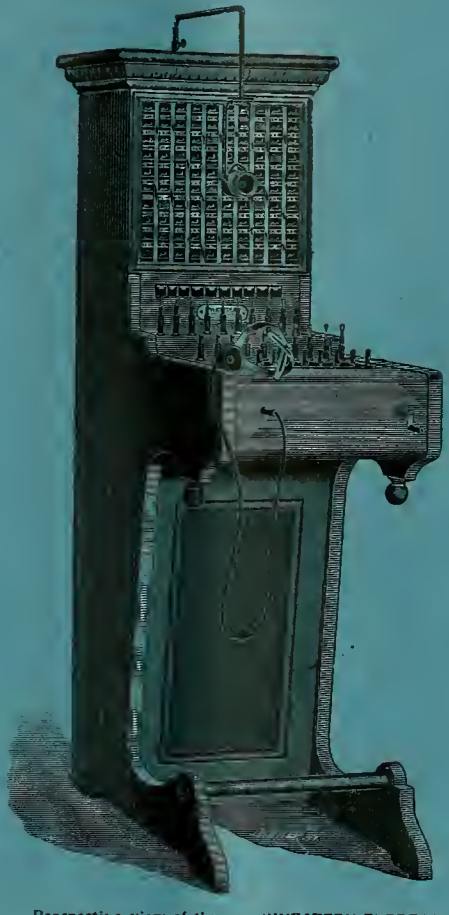

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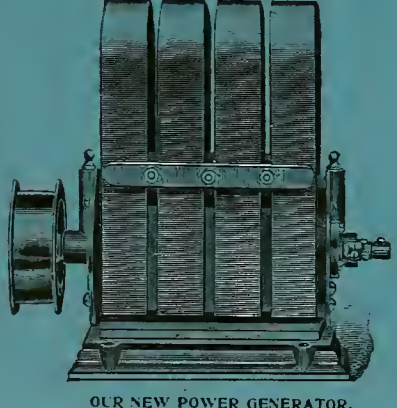

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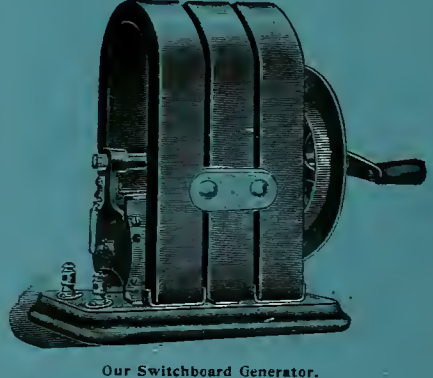

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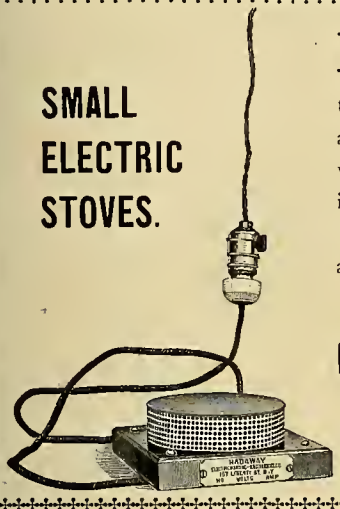

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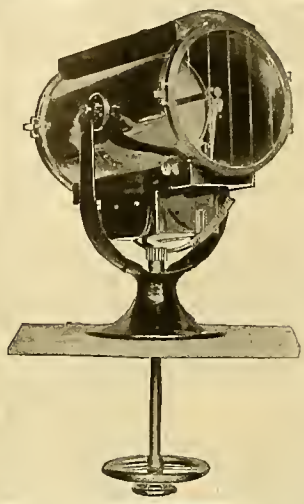

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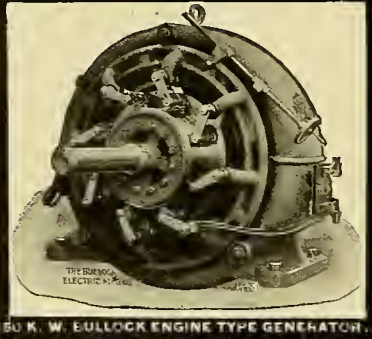

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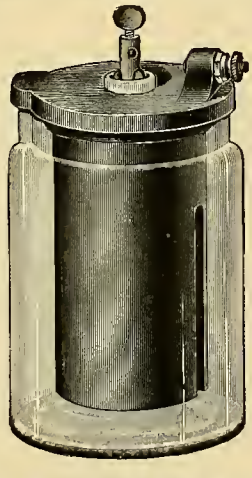

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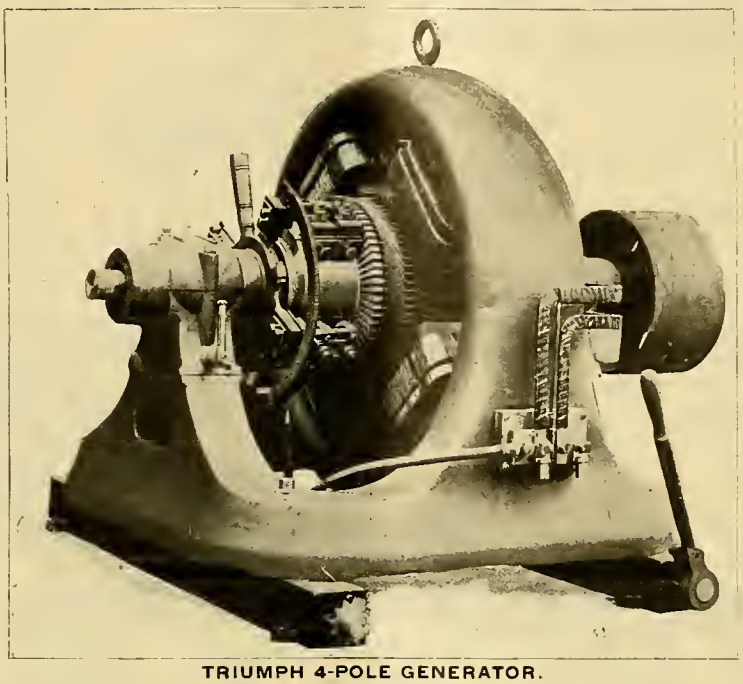

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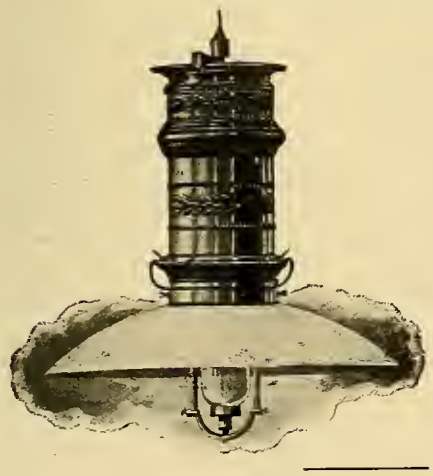
For Constant Potential Circuits are Superior in Points of



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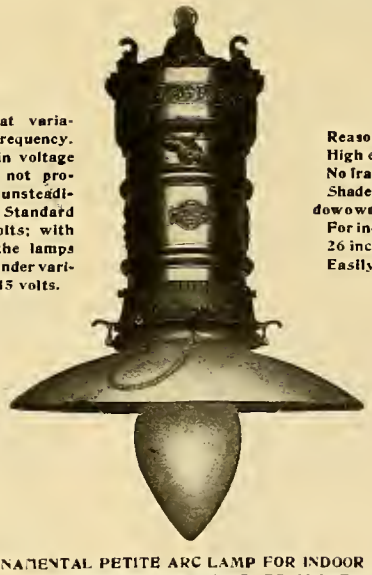
Adapted for great variations in voltage and frequency. Ordinary changes in voltage and frequency do not produce flickering or unsteadiness of the arc. Standard adjustment 104 volts; with this adjustment the lamps will burn steadily under variations from 90 to 115 volts.



Reasonable cost.
High efficiency.
No framework in sight.
Shade reflects upward rays downward.
For indoor and outdoor use.
26 inches long.
Easily trimmed.

ORNAMENTAL PETITE ARC LAMP FOR INDOOR USE, WITH M SHADE AND STANDARD GLOBE L.

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CHICAGO. NEW YORK.

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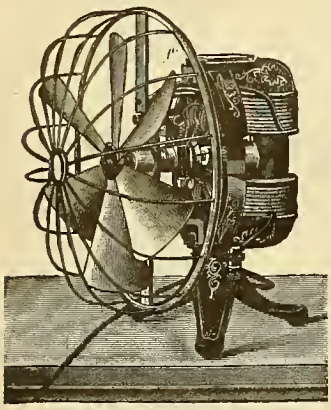

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The only efficient battery fan outfits on the market. Invaluable for the sick room.

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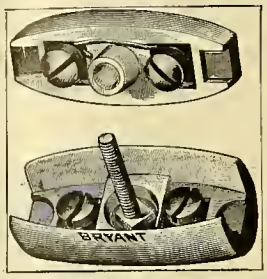

Concave-head contact screws in the base, and convex in the cap, insure a perfect contact where the two connecting wires are of different gange.

The cover, being held in place by but one nut, can be readily removed for fusing.

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INCANDESCENT LAMPS.

QUALITY UNEQUALED.
FACTORY PRODUCTION TRIPLED.

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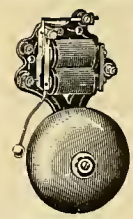

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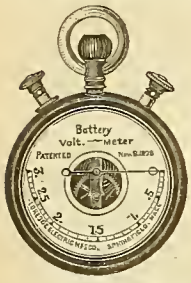

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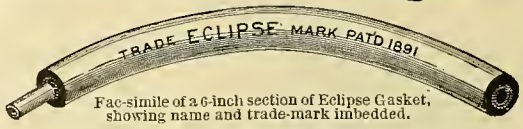

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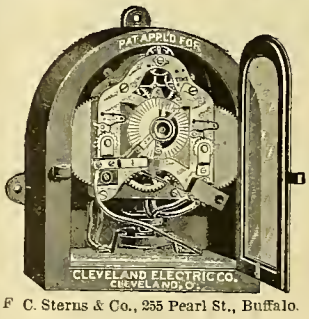

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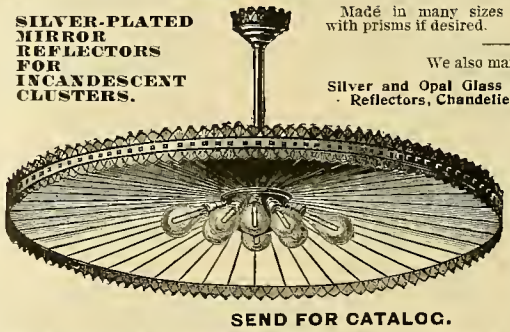

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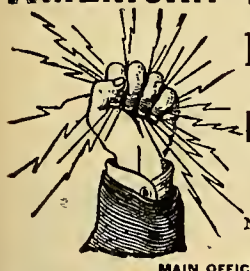

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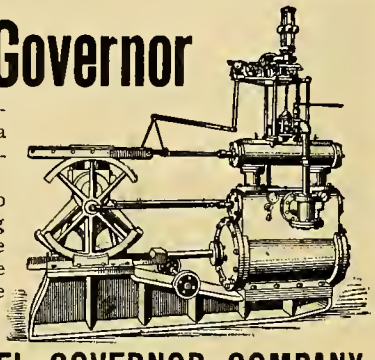

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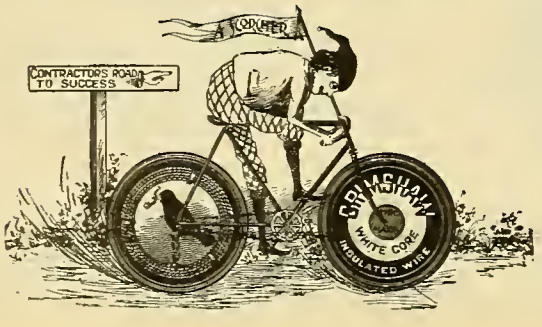

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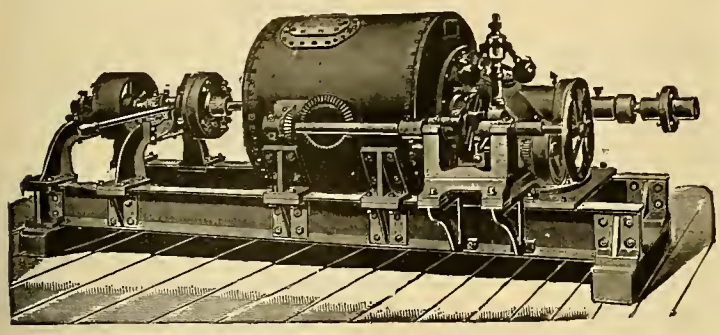

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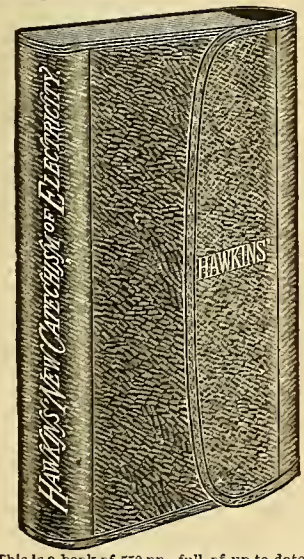

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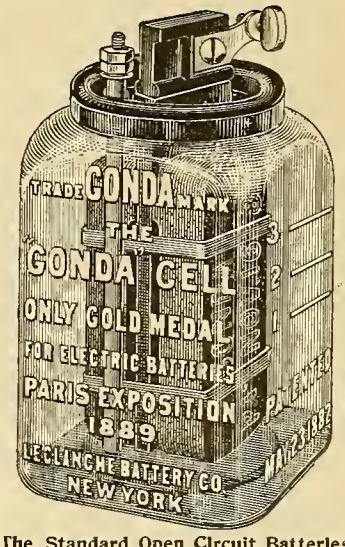

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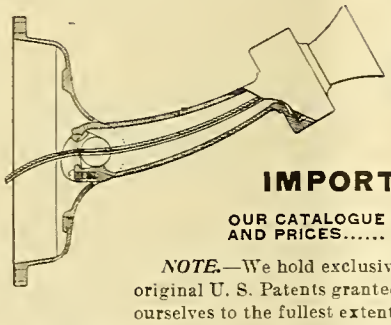

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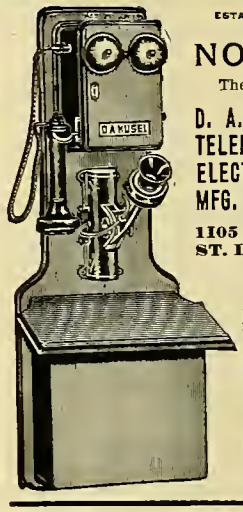

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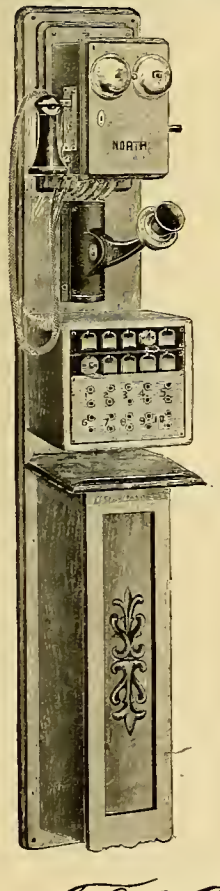

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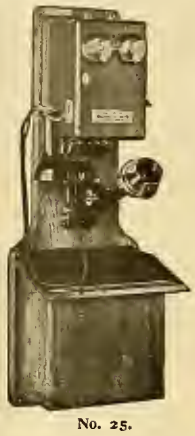

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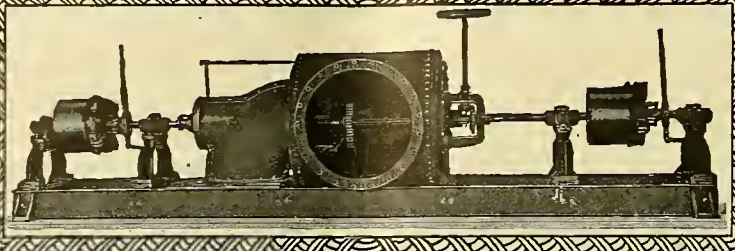

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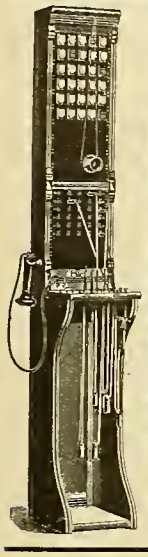

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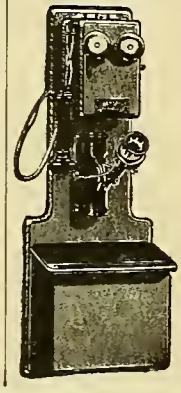

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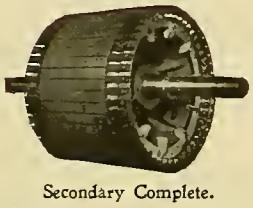

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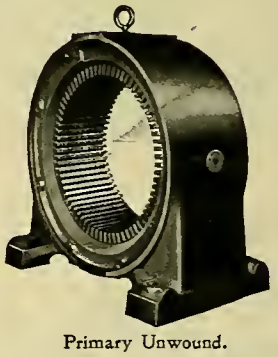
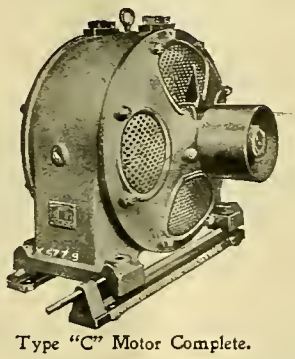


Primary Unwound.

Induction

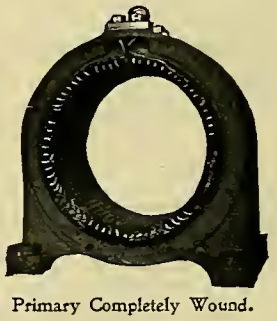


Type "C" Motor Complete.

Motor,

Secondary Core Unwound.

Type "C."



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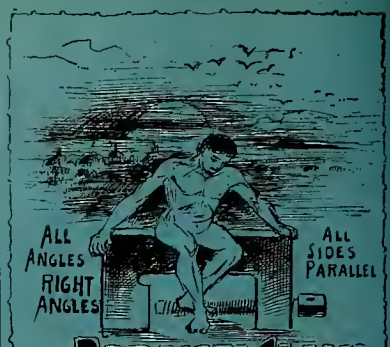

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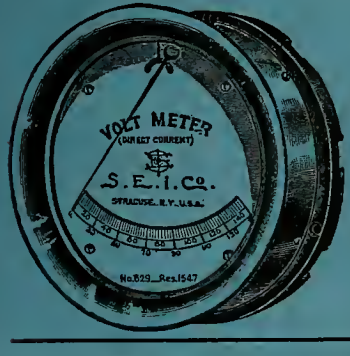

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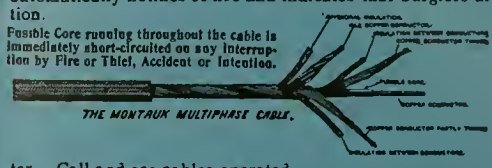

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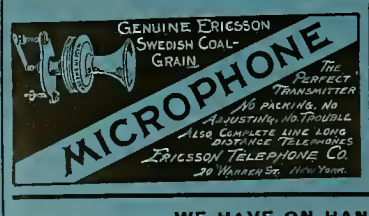

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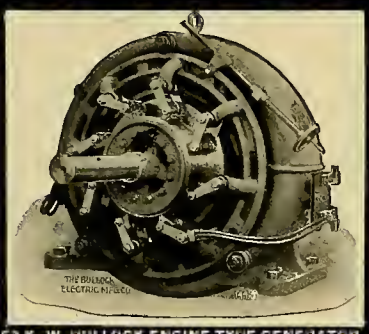

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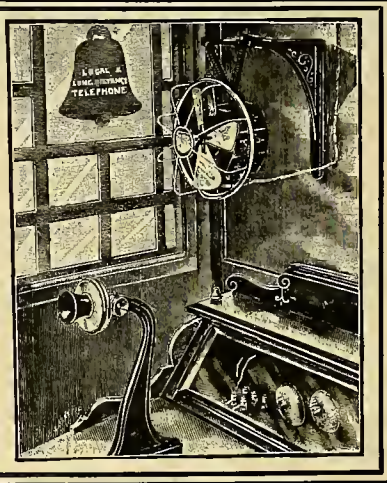

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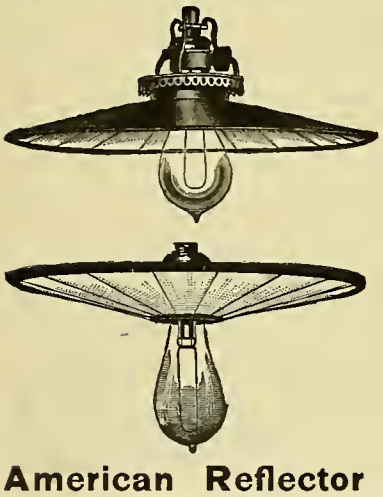
COOL BREEZES
ALL SUMMER.
THE PARAGON FAN
GIVES THEM TO YOU AT A SMALL COST.

CHICAGO EDISON COMPANY, 173 Adams St., CHICAGO.

"HARDY" LAMPS
Give full candle power for longer time than other makes.

HARDY LAMP COMPANY, - PITTSFIELD, MASS.

Kester Electric Mfg. Co
Manufacturers of the Wire Cloth Dynamo and Motor Brushes. Solders and Soldering Fluxes of all kinds.
No. 249-51 So. Jefferson St., CHICAGO, ILL.



SILVER-PLATED MIRROR REFLECTORS.

A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

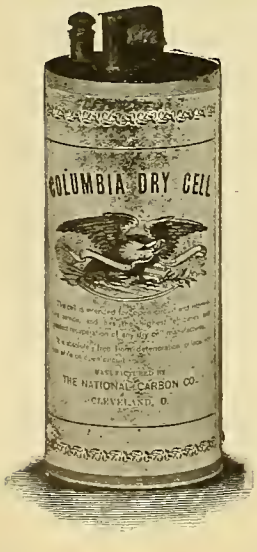
GET OUR PRICES.

American Reflector & Lighting Co.,
271-273 FRANKLIN STREET, CHICAGO.

DOES
Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,
CONSULTING ENGINEERS,
TROY, OHIO.

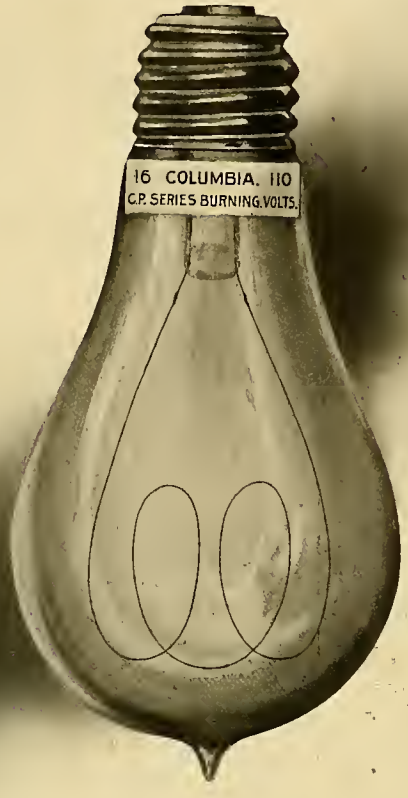


"THE REAL THING."
"Columbia" Dry Cell for All Classes of Open-Circuit Work.
WE CAN PROVE THAT IT IS THE BEST DRY CELL EXTANT.
MADE IN FIVE SIZES, TO SUIT ALL REQUIREMENTS.
SEND FOR PARTICULARS, ALSO OUR GENERAL BATTERY CATALOGUE. IT IS FREE AND WILL INTEREST YOU.

National Carbon Company,
No. 1198 WEST MADISON AVE., CLEVELAND, OHIO.

Columbia Lamps

UNEQUALED IN QUALITY.



The above is a full-size cut of the Columbia Railway Lamp for series burning on street railway circuits, and can be furnished as follows:

16 candle power only.
Voltage: 90 to 125 for series of 5 on circuits of 450 to 600 volts.
Efficiency: 4 watts per candle power.
Plain glass, frosted or superficially colored.
Genuine colored glass—ruby, blue, green, amber and opal.

We guarantee our railway lamps absolutely uniform in current consumption, thereby giving a uniform distribution of light throughout the car. The filament is unanchored, having a 2½-turn coil, which gives it necessary stability and prevents any possibility of breakage from vibration. Our present style of railway lamp has been in use on some of the largest street railway systems of the country for nearly two years, and we have never received a single complaint.

We also manufacture a special lamp for headlight use on street railway circuits. The lamp is spherical, two inches in diameter, and the filament is so constructed that the light is concentrated into a very small space. It can be furnished either plain, frosted or in genuine colored glass; colors, ruby, blue, green and opal. In the colored glass it is well suited to decorative lighting in trolley party cars.

THE COLUMBIA INCANDESCENT LAMP CO.,

MAIN OFFICE AND FACTORY:

1910-12-14 Olive Street, - ST. LOUIS, MO.

NEW YORK OFFICE: 1311 HAVEMEYER BUILDING.
CHICAGO: CENTRAL ELECTRIC CO.
SAN FRANCISCO: 120 SUTTER STREET.
MINNEAPOLIS: 295 SYNDICATE ARCADE.

AN OPPORTUNITY FOR MANUFACTURERS.

PRACTICALLY NOISELESS

Alternating Arc Lamp.

Greatest subdivision of arc light ever produced.
Simplest lamp on the market.

2½ amp. 60 v., length of arc	½ in.	2½ amp. 75 v., length of arc	⅜ in.
1¾ " 40 " " "	⅜ in.	2 " 30 " " "	⅛ in.
2 " 45 " " "	⅛ in.	2 " 40 " " "	⅛ in.
1½ " 70 " " "	⅜ in.	1¾ " 50 " " "	⅜ in.

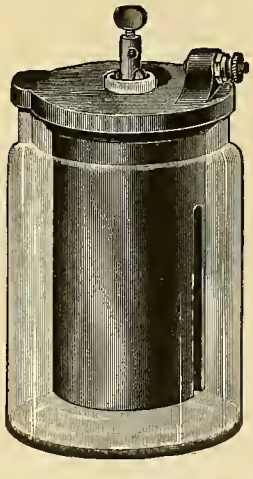
The same lamp adjusted from 60 to 500 watts and either for direct or alternating current.

FOR FURTHER PARTICULARS ADDRESS

A. HAMACEK, Sturgeon Bay, Wis.

SINGLE CYLINDER CARBON CELL.

The Carbon—
The Zinc—
The Sal-ammoniac—
The Metal Connections—
The Bushing—
The Glass Jar, round or square—
The Paraffining—



COMPLETE.

50 IN A BBL.

Are all kept to the highest standard of quality, but the price is cut way down to 18c.

WRITE TO US FOR DISCOUNTS ON THIS PRICE.

PHŒNIX BATTERY MFG. CO.,

ST. LOUIS, MO.

Slipping Belts
COMPEL
Tight Belts.

R. C. CARPENTER, Professor Experimental Engineering at Cornell University, says: "When a belt is full of

CLING-SURFACE

the only limit to its transmitting capacity is the strength of the belt," and "when transmitting its full capacity the belt can be run so slack that the sides nearly touch."

CLING-SURFACE is a filler and preservative for belts, which will prevent all slipping and prolong the life of the belt many times. Send to us for report of tests by Prof. Carpenter.

CLING-SURFACE MFG. CO.,
177-182 VIRGINIA STREET, BUFFALO, N. Y.
CHICAGO BRANCH, 225 DEARBORN STREET.

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Leather Preserver Mfg. Corp.

Belting.
Chicago Belting Co.
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Peerless Rubber Mfg. Co.
Shultz Belting Co.

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Bryant Electric Company.
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Mass. Chemical Co.
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Ruxton, Robert.

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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

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Baker & Co.
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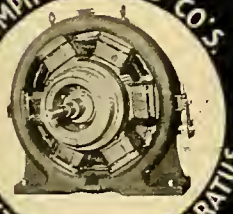
ENGINEERS AND CONTRACTORS FOR STREET RAILWAY AND LIGHTING PLANTS.

OFFICES AND SHOW ROOMS
13 AND 15 MONADNOCK BLOCK. CHICAGO.

WESTERN AGENTS FOR

TRIUMPH ELECTRIC CO'S. DIRECT CURRENT APPARATUS



THE
EMPIRE ELECTRICAL INSTRUMENT CO.
MANUFACTURE
SWITCHBOARD INSTRUMENTS
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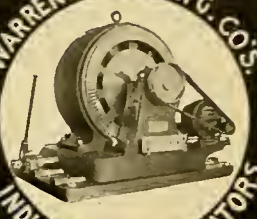

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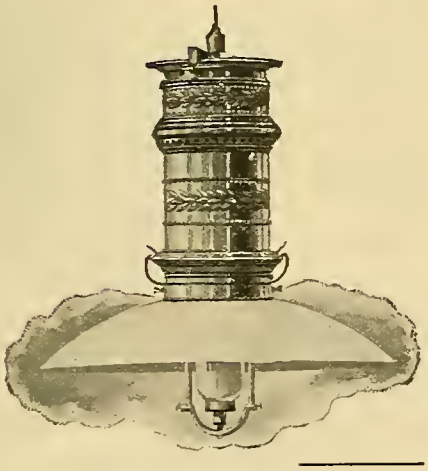

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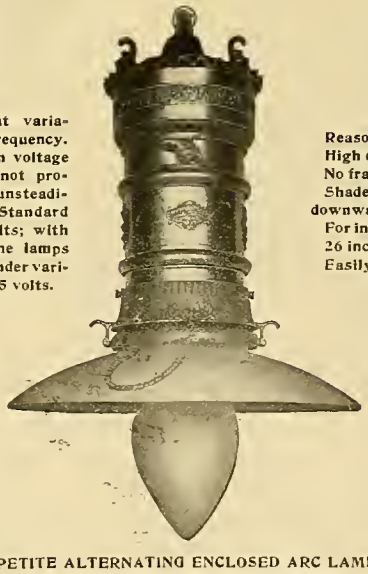

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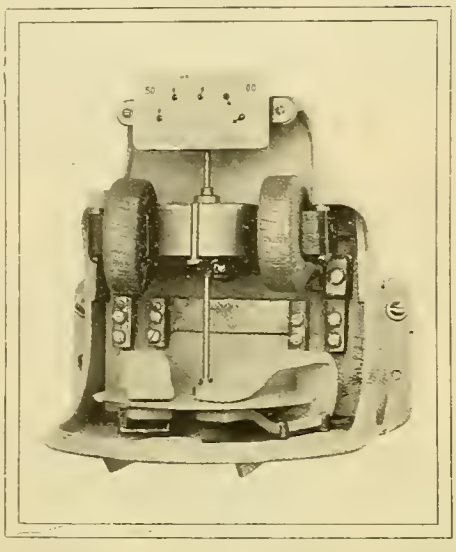

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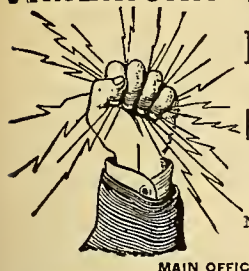

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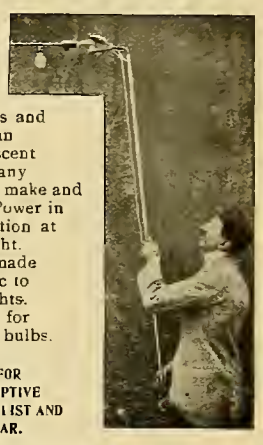

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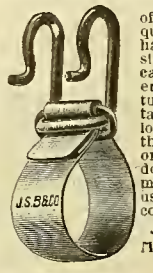

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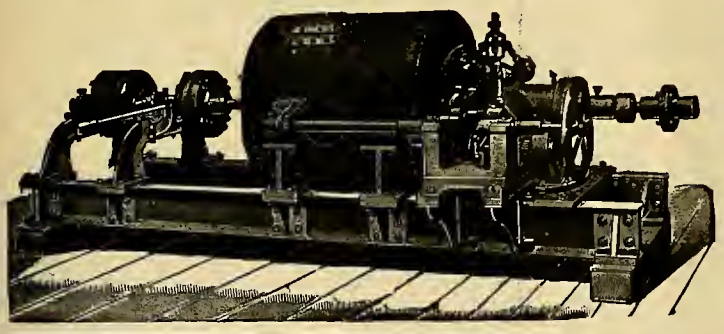

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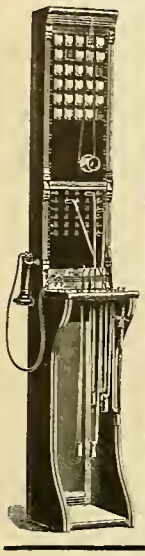

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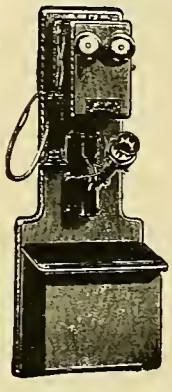

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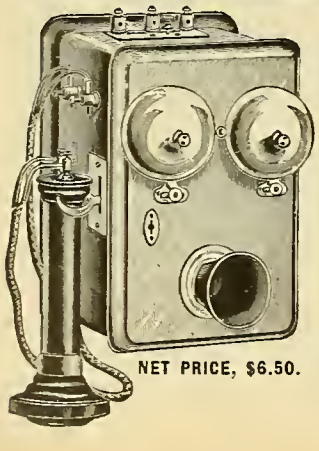

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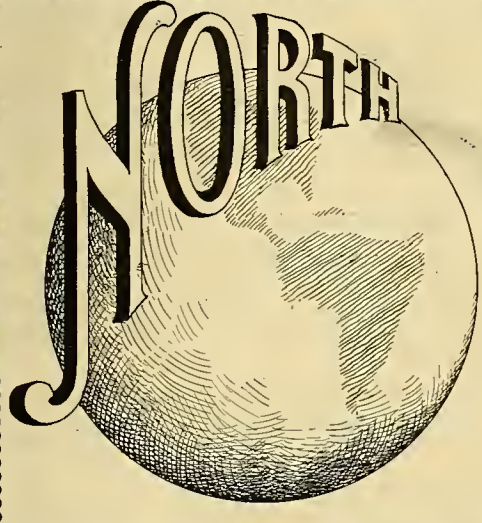

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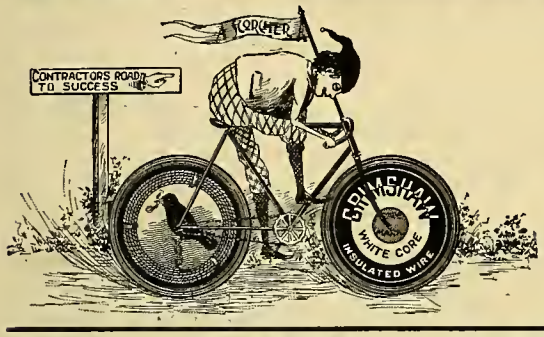

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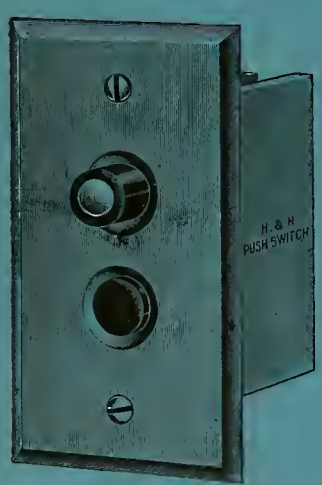

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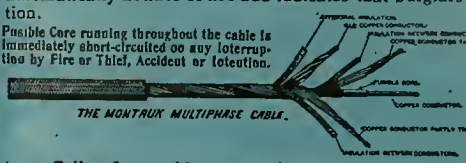

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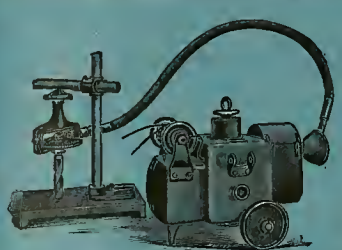

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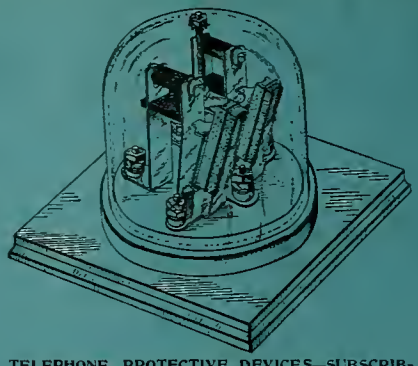

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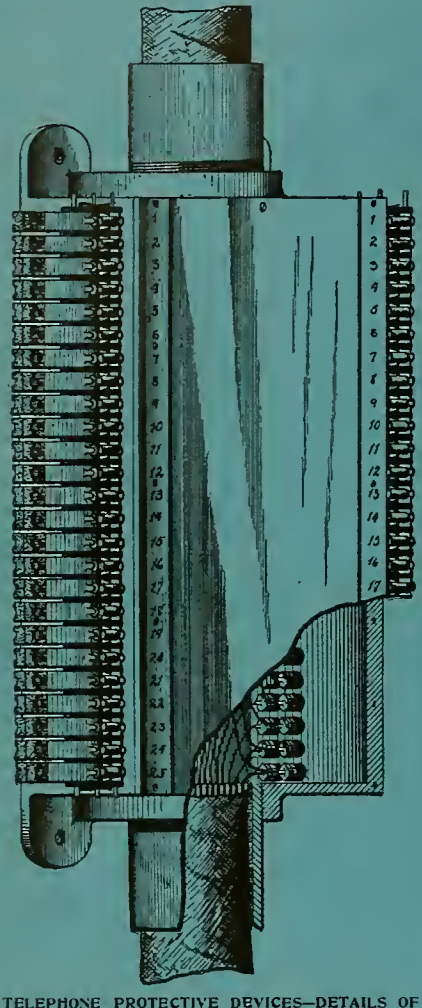

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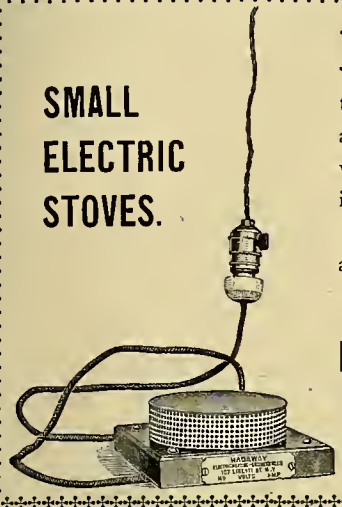

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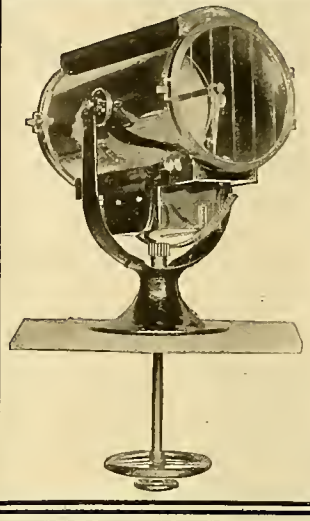

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THE PARAGON FAN
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"HARDY" LAMPS Give full candle power for longer time than other makes.
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Direct and Alternating Current Apparatus for Lighting and Transmission of Power.

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ARE THE

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WHICH MAY BE DEPENDED ON. . .
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Jos. H. Perkins
Ass't Gen'l Manager.

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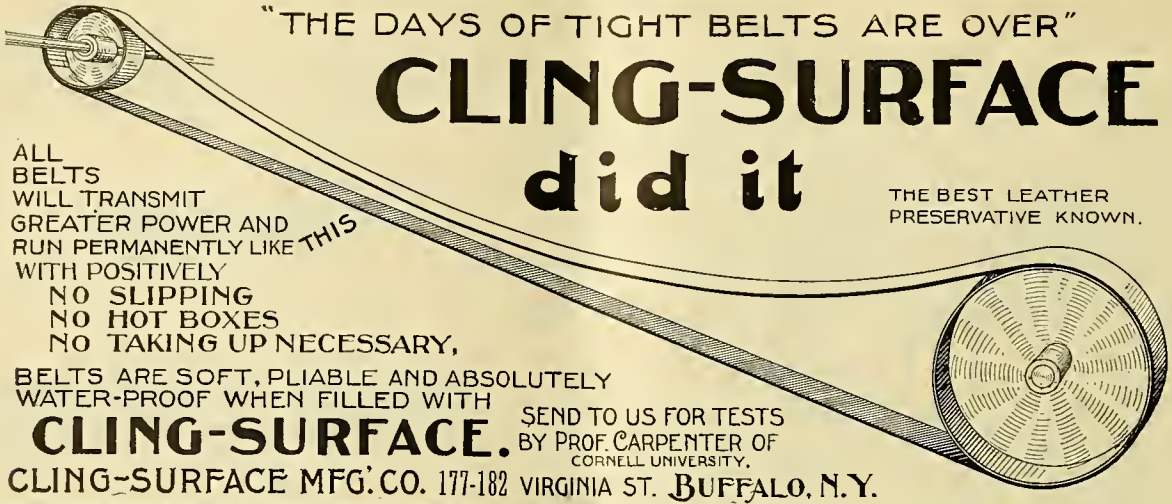

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Ft. Wayne Elec. Wks., Inc.
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Paiste Co., H. T.
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Standard Underground C. Co.
Sterling Varnish Co.
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Eastern Electric Cable Co.
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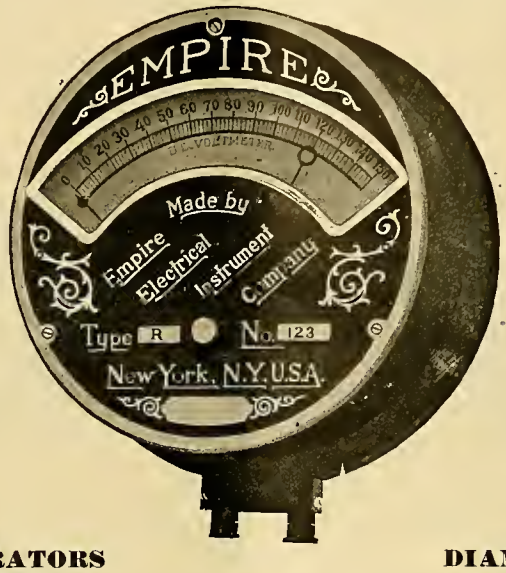

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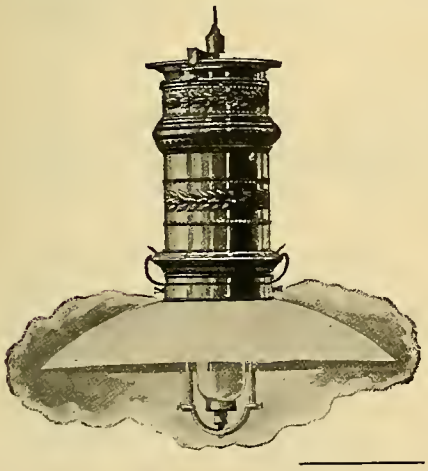
For Constant Potential Circuits are Superior in Points of



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Reasonable cost.
High efficiency.
No framework in sight.
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26 inches long.
Easily trimmed.

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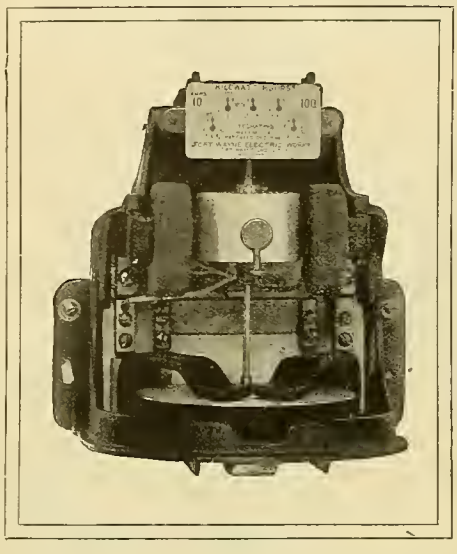
(INCORPORATED)



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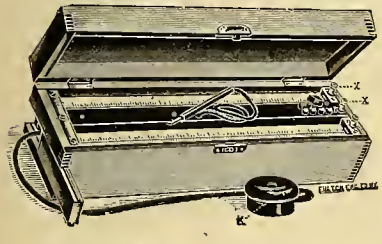

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In a machine shop
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What is the Resistance of its Field?

You try with a testing set
And level
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And add
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You use a direct-reading ammeter and get the results twelve seconds after the connections are made.

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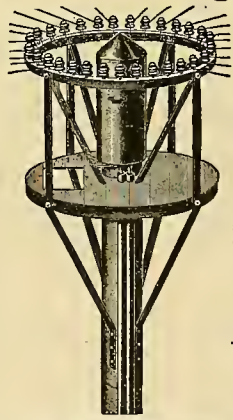

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ABSOLUTELY WILL NOT GUM THE BRUSHES....

It will put that high gloss on the commutator you have so long sought after.

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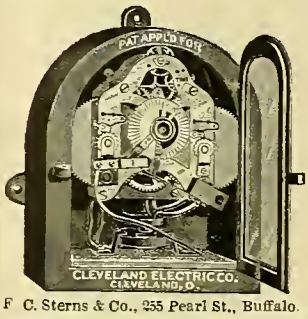

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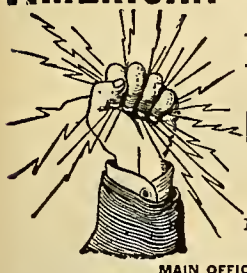

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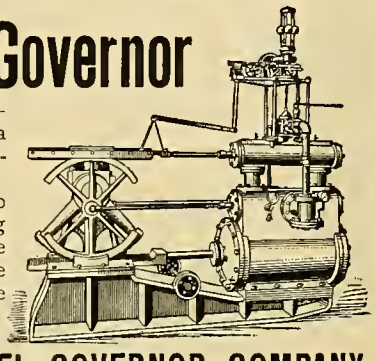

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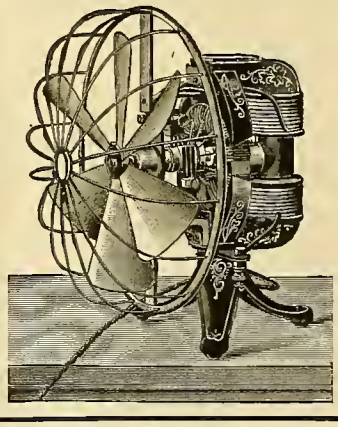

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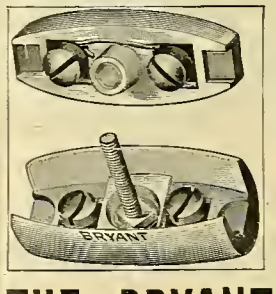

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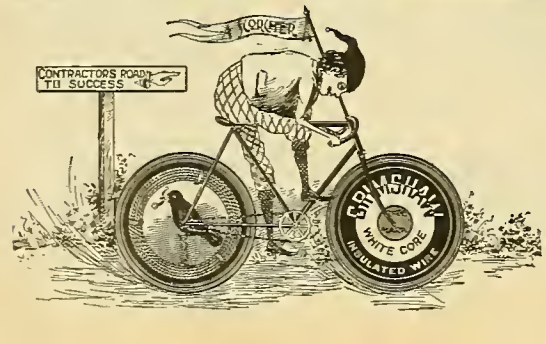

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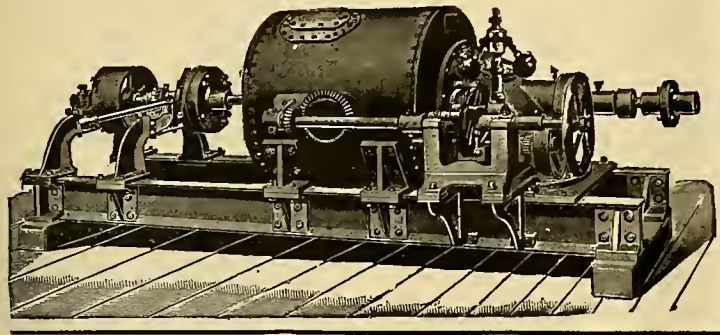

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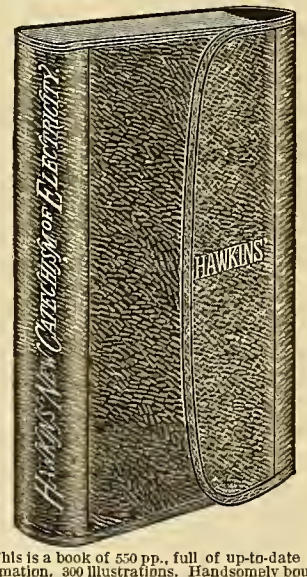

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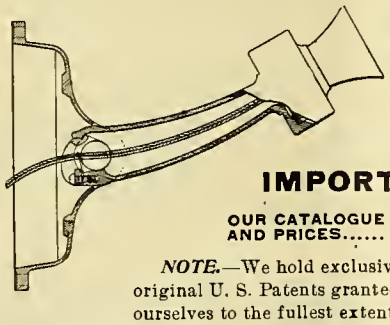

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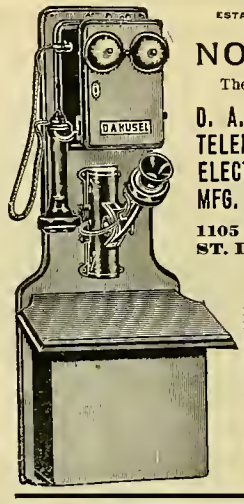

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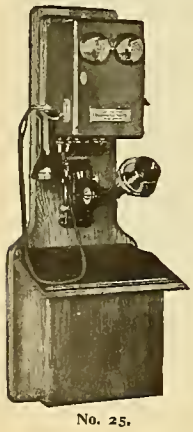

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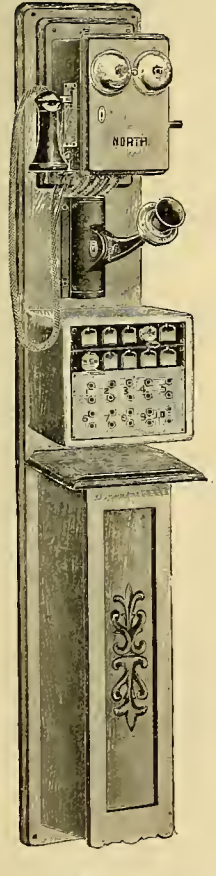

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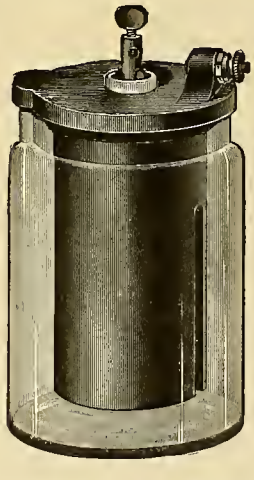

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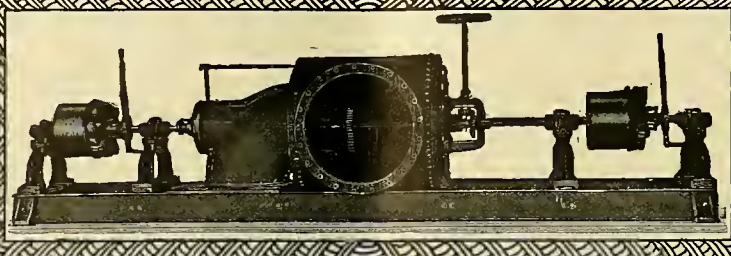

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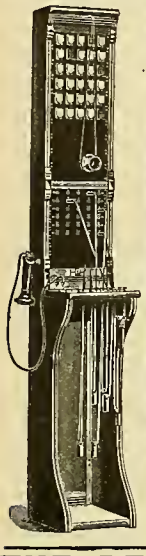

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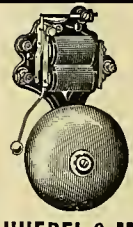

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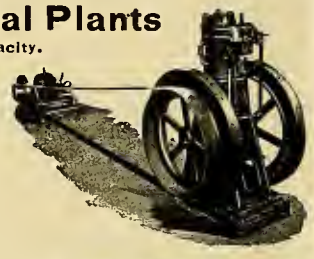

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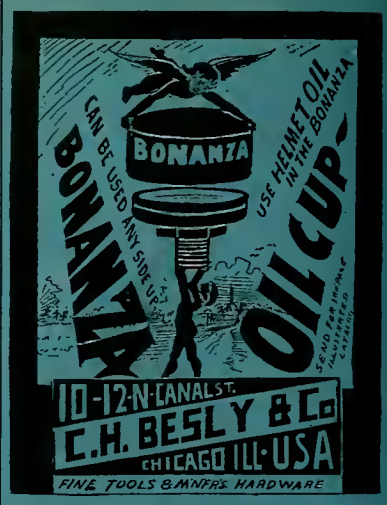

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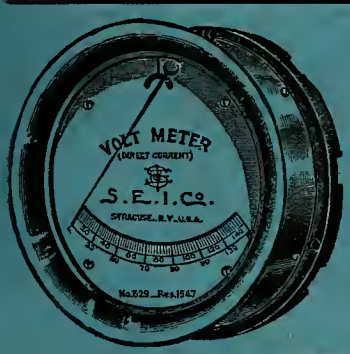

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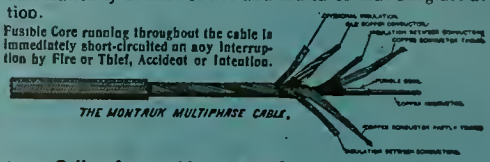


THE MONTAUK MULTIPHASE CABLE.

Why use dormant wires? The Mootauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human beiog is to the touch of flame.

Write for descriptive matter. Call and see cables operated.

MONTAUK MULTIPHASE CABLE CO.,

Telephone 4031 Cortlandt. 100 Broadway, NEW YORK.

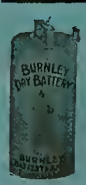
2,000 IN USE.

Bipolar and Multipolar Motors from ¼ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

Queen & Co.,

1012 Chestnut St., PHILADELPHIA.

Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils.



FOR ALL OPEN-CIRCUIT WORK

Points of Superiority Over All Other Types.

In successful use for ten years. **Standard high. Prices low.** Send for descriptive circular and testimonials.

The Burnley Battery & Mfg. Co., PAINESVILLE, OHIO.

Chicago Belting Company

MAKERS OF LEATHER BELTING — RELIANCE — DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

The production of our Dynamo brand of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and in all climates.

When ordering Dynamo Belting always state the system used.

OFFICE AND FACTORY 67-69 SOUTH CANAL STREET CHICAGO, ILL.

NEW ORLEANS ST. LOUIS MEMPHIS

WE BUY AND SELL

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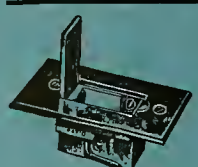
C. F. SPLITDORF,

X-Ray Coils, Telephone Coils. Medical Coils, Spark Coils.

17-27 Vandewater St., New York.



THE BEST—THE "NEW STYLE" Receptacle and Attachment Plug.

The latest in this line is the "NEW STYLE" made by

WM. T. PRINGLE, 1026 Filbert Street, PHILADELPHIA.

Western Representatives: J. B. McKeague Co., 324 Dearborn St., Chicago.

WE HAVE ON HAND THE FOLLOWING

Three Braid Weather-Proof Copper Wire:

500 lbs. No. 0. 800 lbs. No. 4. 575 lbs. No. 6.

Will make close price. Write Us.

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The Fibre-Graphite Commutator Brush.

(U. S. and Foreign Patents.)

No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.

For Sample Order, and Prices, write to

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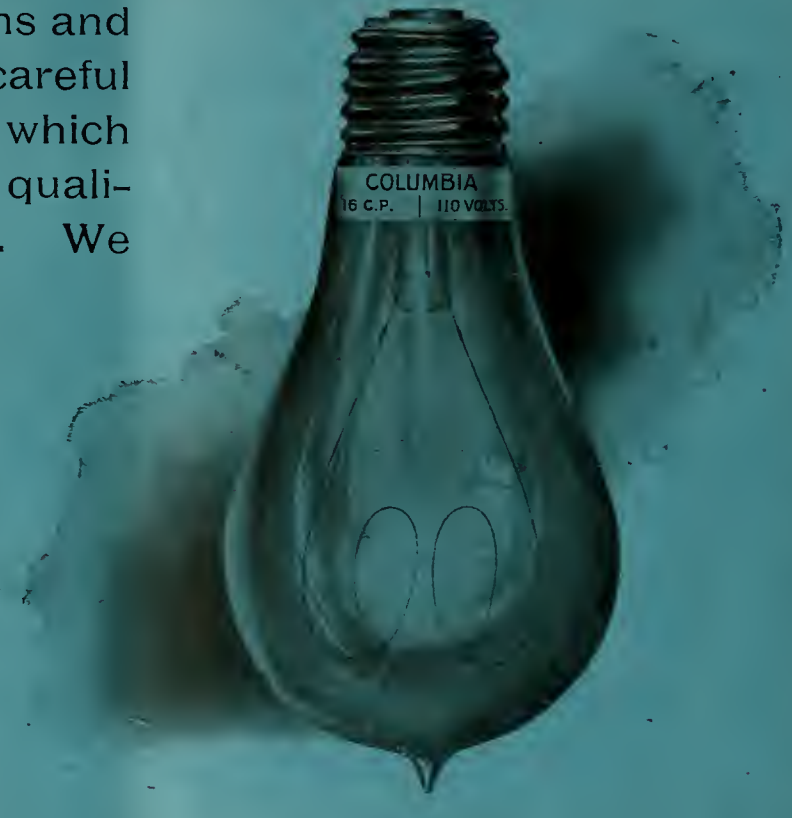
COLUMBIA LAMPS

ARE UNEQUALED IN QUALITY

Before renewing your contracts or placing your orders for fall and early winter requirements in incandescent lamps, we request Central Stations and Isolated Plants to give careful consideration to the claims which we make for the superior qualities in Columbia lamps. We guarantee that Columbia lamps will be found absolutely uniform in initial readings for candle power, voltage and efficiency. We have been actively engaged in the manufacture of incandescent lamps for more than ten years, and therefore consider that our guarantee is worth something.



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The Columbia Incandescent Lamp Co.

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SAN FRANCISCO: 120 Sutter Street.
MINNEAPOLIS: 295 Syndicate Arcade.

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Dearborn Drug and Chemical Works,

MANUFACTURING AND ANALYTICAL CHEMISTS.

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Offices: 29, 30, 31, 32, 33 Rialto Bldg. *Telephone Harrison 1373.* Works: 2325, 2327, 2329 La Salle St. *Telephone No. 1130 South.*

Copper is Still Up

And we don't know when it will come down. At any rate, stocks of metal don't increase, and the demand for electrical purposes alone was never so great. We carry the finished product and maintain a large range of sizes in ample stock of **Okonite Waterproof and Banner and K. K. Weatherproof Wires.**

Fall Construction and Wiring need suffer no delay when orders for wire and supplies are placed wish us.

Central Electric Company,

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Southern Electrical Supply Co., St. Louis.

OKONITE IT NEVER DISAPPOINTS

"THE REAL THING."

"Columbia" Dry Cell for All Classes of Open-Circuit Work.

WE CAN PROVE THAT IT IS THE BEST DRY CELL EXTANT.

MADE IN FIVE SIZES, TO SUIT ALL REQUIREMENTS.

SEND FOR PARTICULARS, ALSO OUR GENERAL BATTERY CATALOGUE. IT IS FREE AND WILL INTEREST YOU.

National Carbon Company,

No. 1198 WEST MADISON AVE., CLEVELAND, OHIO.

CHICAGO INSULATED WIRE CO.

152-154 Lake St.

CHICAGO, ILL. U.S.A.

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CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

"HARDY" LAMPS Give full candle power for longer time than other makes.

HARDY LAMP COMPANY, - PITTSFIELD, MASS.

LONDON. PARIS.

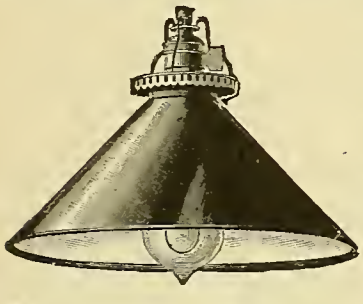
TROTTER'S COMMUTATOR COMPOUND NEW YORK

MONA COMMUTATOR COMPOUND,

The most efficient lubricator, is the only article that is guaranteed to stop sparking. It can be used on leaf, carbon or gauze wire brushes with the greatest safety. Puts a beautiful luster on the Commutator. Does away with the use of sandpaper or any other material that wears out or destroys its surface. It is the largest and most economical stick manufactured. It comes in two sizes. Small size, $3.00 per dozen. Large size, $5.00. Samples mailed free on application. For sale by all supply houses throughout the United States, England and Canada.

Manufactured only by TROTTER'S MONA MFG. CO., Ltd., No. 65 West Broadway, New York City.
Messrs. GOLOMARK & WALLACE are the Sole Agents for the United States, 121 Worth St., New York City.
SATISFACTION GUARANTEED OR MONEY REFUNDED.

REFLECTORS!



Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

American Reflector & Lighting Co.,

271-273 FRANKLIN ST., CHICAGO.

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Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

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THE WOOD ELECTRIC

MOTO-VEHICLES.

SEND FOR "SPECIALLY FINE" CATALOGUE.

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That the material and workmanship in the vehicle shall be of the very best, including rubber tires and ball bearing axles.

That for a period of one year the Company will replace, free of charge, any broken parts due to defective material or faulty shop construction.

That the vehicle shall have, on a level hard roadway, a mileage capacity in one charge of the batteries that will carry its given load twenty-five miles at an average speed of twelve and one-half miles per hour, two hours.

That the batteries can be charged when fully discharged in two and one-half hours' time.

That the vehicle shall be capable of climbing a six per cent. grade with given load when batteries are reasonably well charged.

That for the sum of $50 00 per annum, the Company will furnish all parts for keeping batteries in perfect repairs for a period of five (5) years, leaving them at the end of the five years in good condition for operation during the ensuing year.

AVERAGE COST TO RUN PER MILE, 3-4 CENT.

FISCHER EQUIPMENT CO.,

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"MIDGET" ENCLOSED ARC LAMP

FOR CONSTANT-CURRENT CIRCUITS.

For Street and Commercial Lighting.

Is more economical in operation than any other constant-current enclosed arc lamp on the market.

Will burn 125 to 150 hours with one 12x1-2 inch solid carbon.

Has been successfully used all over the country for more than two years by electric-light stations and large corporations.

Burns on circuits of from 5 to 7 amperes without any change in adjustment. All other makes of constant-current lamps require readjusting.

At 5 amperes equal to 1,200 C. P. open arc lamp.

At 6.8 amperes equal to 2,000 C. P. open arc lamp.

Gives steady white light, with no noise, flashing or dropping of sparks.

Where desired, we furnish a positive cut-out of compact and improved design.

For indoor service, the single globe lamp can be furnished. For street service, a metal reflector can be furnished in addition to the double globe.

Full particulars, circulars and prices furnished on application.

STANDARD THERMOMETER & ELECTRIC CO.

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WHERE
CLING-SURFACE
IS USED

THE DAYS OF TIGHT BELTS ARE OVER.

No slipping, no hot boxes, no taking up. Belts run easy, slack and with greatly increased power.

Let us send you reports of tests by Prof. Carpenter of Cornell University.

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Chicago Branch, 535 538 Temple Court Bldg., 225 Dearborn St.

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Weston Electrical Inst. Co.

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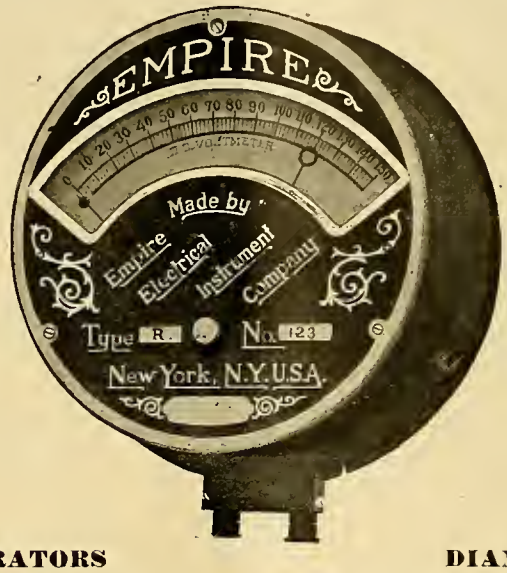

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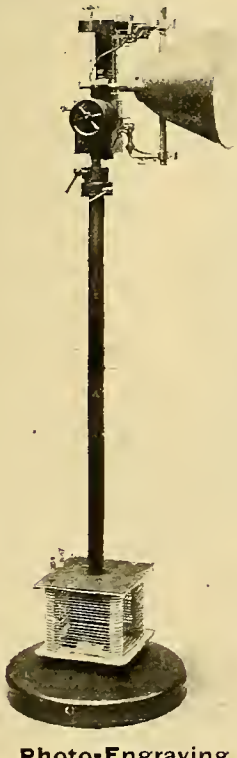

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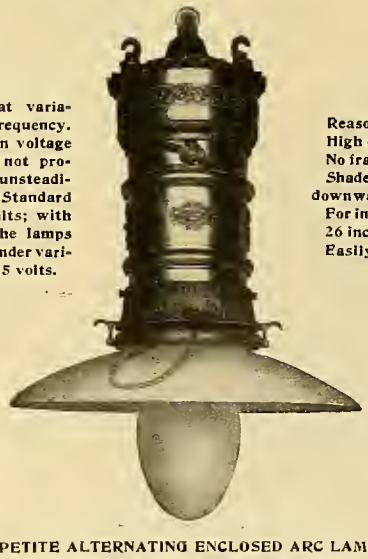

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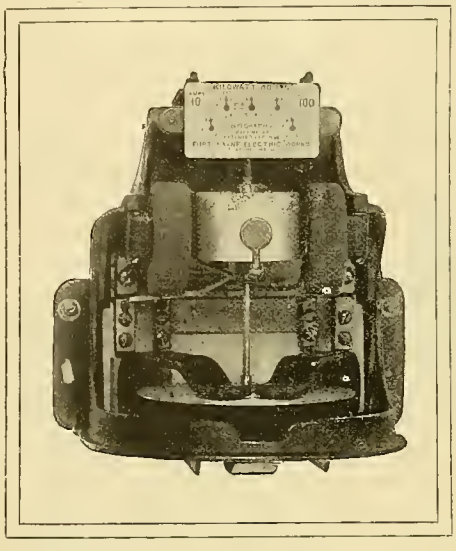

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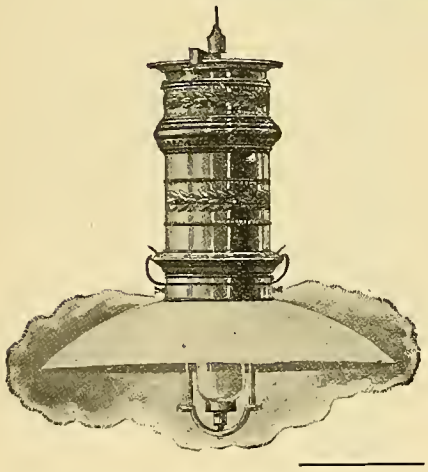

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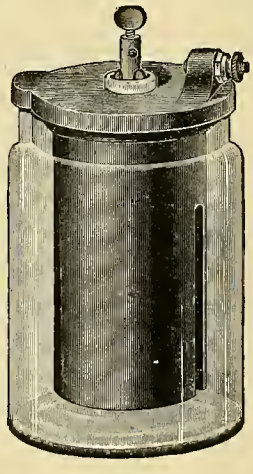

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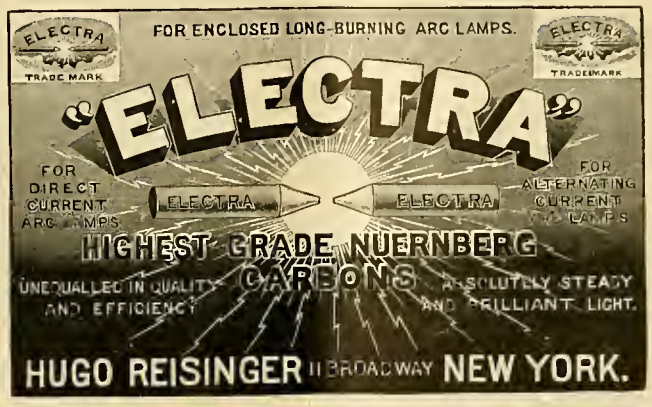

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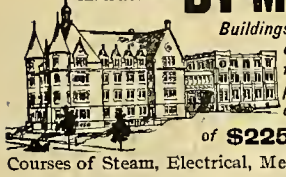

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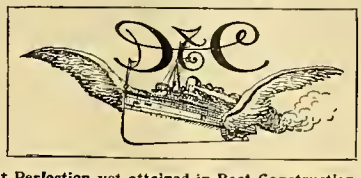

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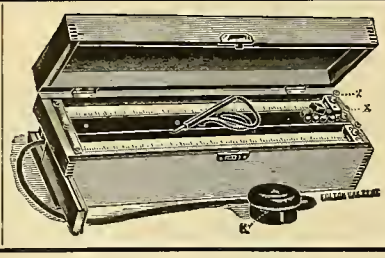

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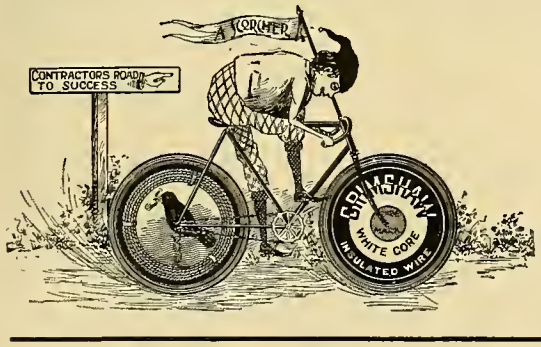

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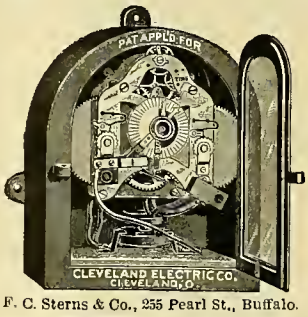

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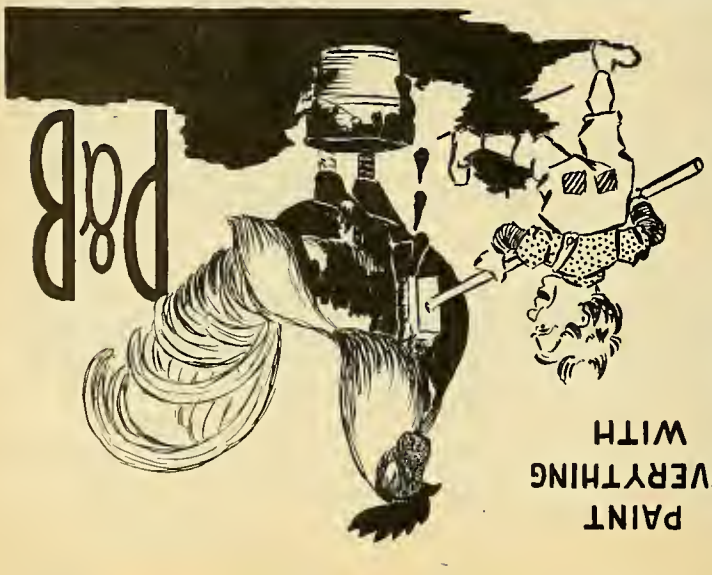

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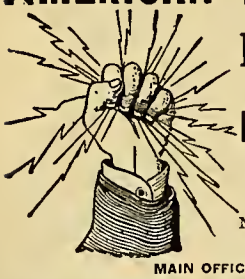

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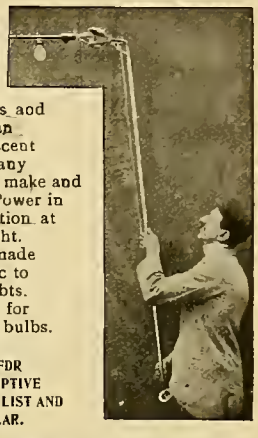

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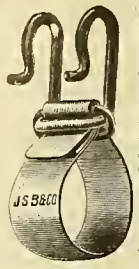

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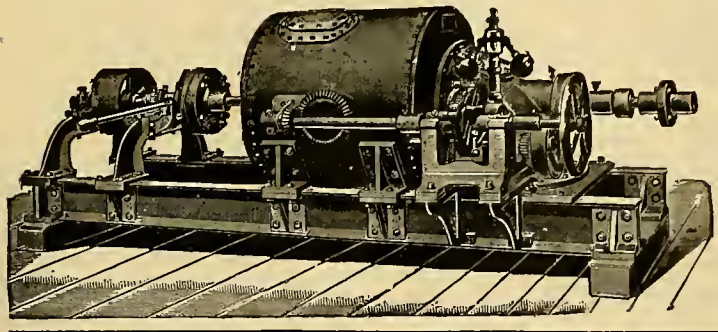

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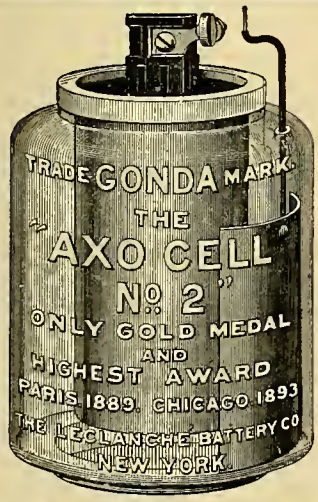

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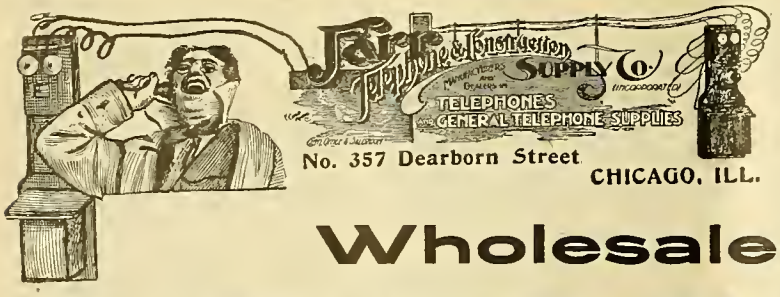

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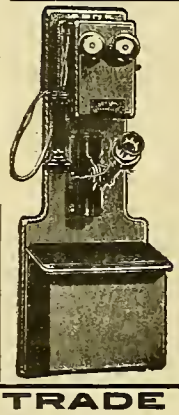

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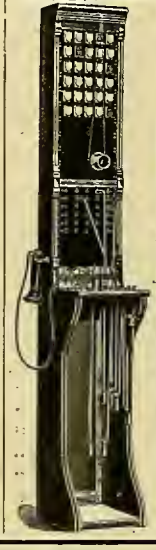

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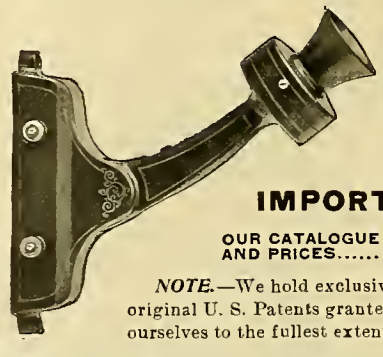

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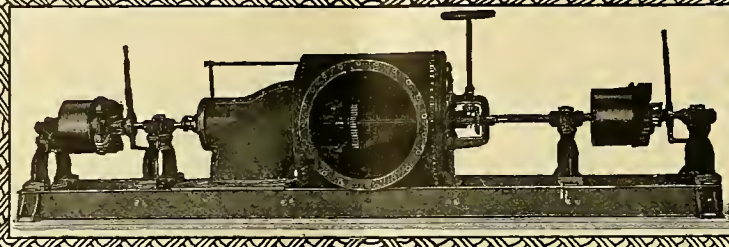

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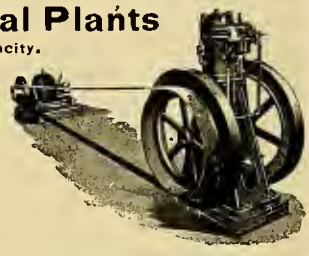

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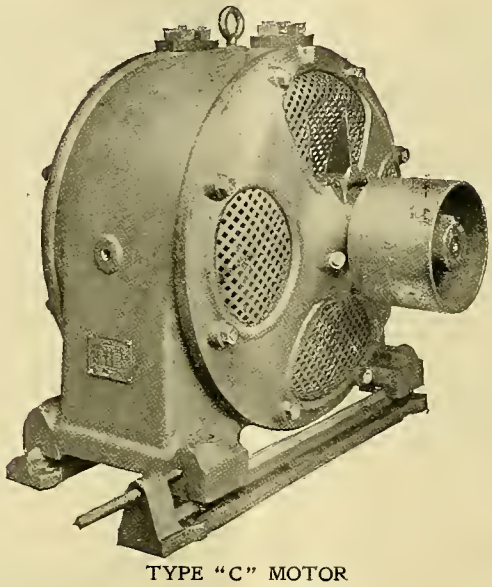

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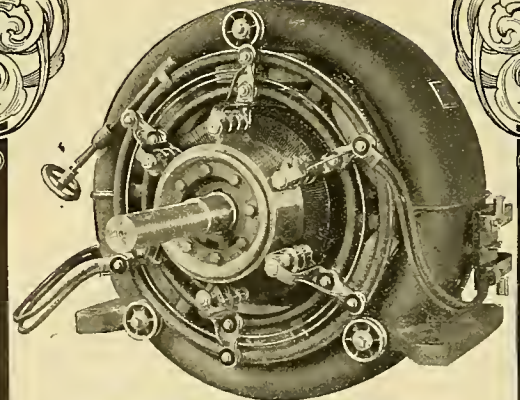

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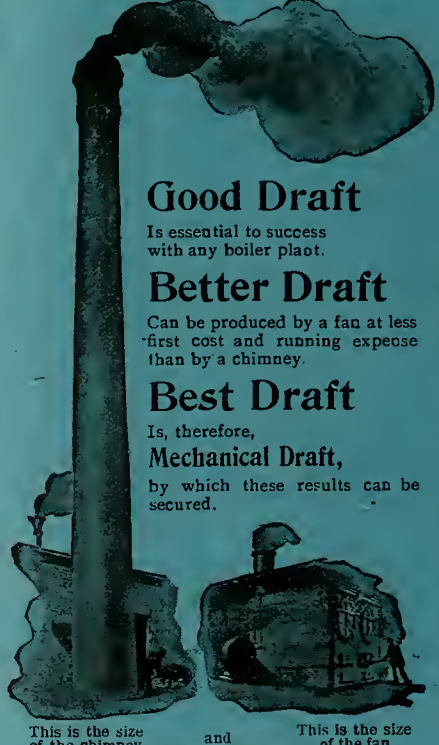

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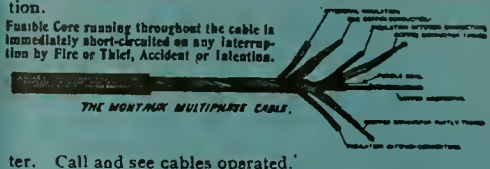

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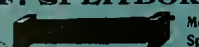

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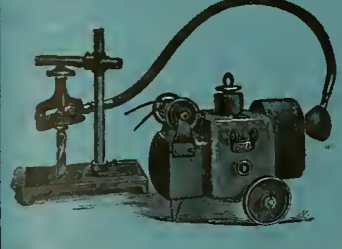

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The First Edison Company to Use the Chloride Accumulator

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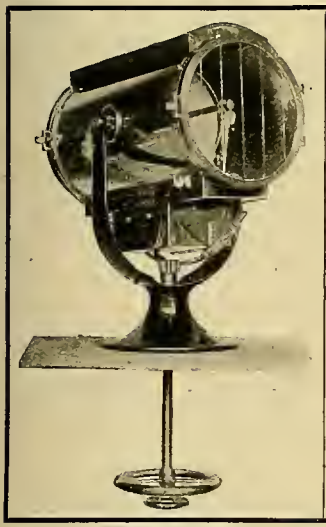

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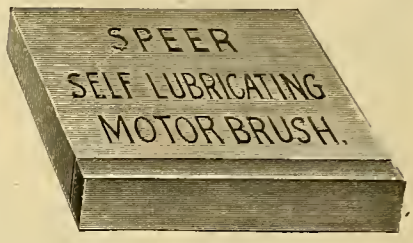

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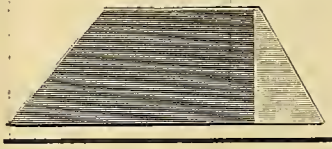

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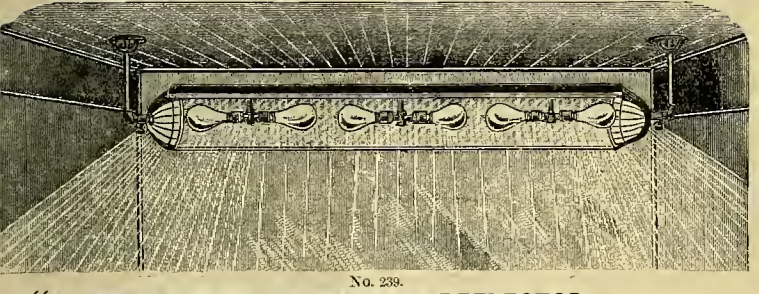

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"KLEMM" PATENT ADJUSTABLE REFLECTOR, cheapest and best Reflector for lighting **Show Windows and Art Galleries.**

"KLEMM" ADJUSTABLE DESK SHADES, the best in the market.

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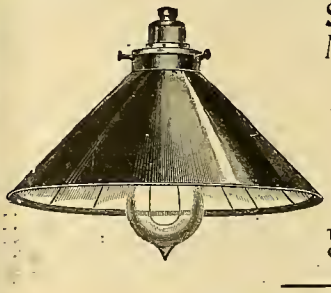

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American Reflector & Lighting Co.,

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WRITE FOR PRICES.
CHICAGO EDISON COMPANY,
139 ADAMS STREET, CHICAGO.

"HARDY" LAMPS Give full candle power for longer time than other makes.
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Let us send you description and prices.

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Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

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Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.
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We make a specialty of apparatus for the transmission of Electrical Power through factory or other buildings.
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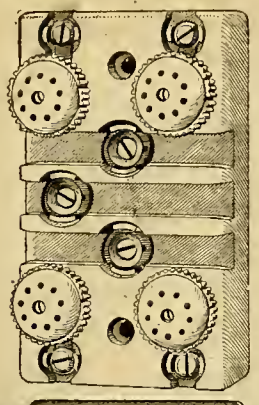
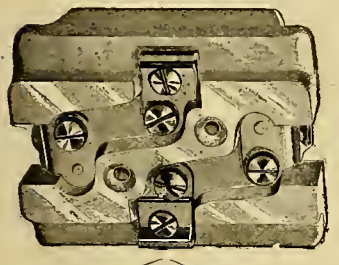
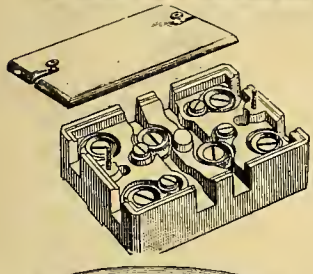
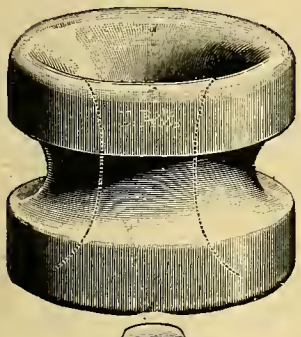
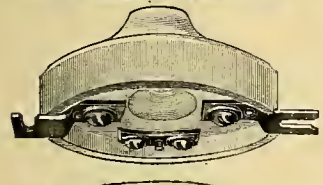
SAN FRANCISCO, CAL., California Elec. Works, 409 Market St.
NEW YORK OFFICE, Singer Bldg., 149 Broadway.
BOSTON, G. W. Angier & Co., 64 Federal St.
ST. LOUIS, Western Electrical Supply Co.
CINCINNATI, Nevada Bldg. John A. Stewart.

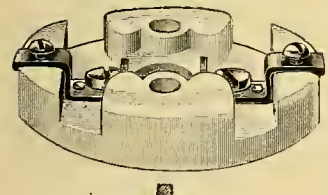


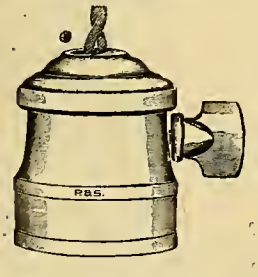












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ST. LOUIS.

OKONITE IT NEVER DISAPPOINTS

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AND

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ARE THE

"U. S. NAVY STANDARD."

THIS MEANS THAT THEY ARE

THE BEST IN THE WORLD.

Send for our Several New Reduced Price Lists Issued in July and August, 1899.

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THE BULLOCK ELECTRIC MFG COMPANY

CINCINNATI OHIO

SEND FOR BULLETIN NO. 2234.

83 8-'99

Slipping Belts

COMPEL

Tight Belts.

R. C. CARPENTER, Professor Experimental Engineering at Cornell University, says: "When a belt is full of

CLING-SURFACE

the only limit to its transmitting capacity is the strength of the belt," and "when transmitting its full capacity the belt can be run so slack that the sides nearly touch."

CLING-SURFACE is a filler and preservative for belts, which will prevent all slipping and prolong the life of the belt many times. Send to us for report of tests by Prof. Carpenter.

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CHICAGO BRANCH, 225 DEARBORN STREET.

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Morris Arc Lamp Co.
Siemens & Halske Electric Co of America
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Arc Light Cord.
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Leather Preserver Mfg. Corp.
Schultz Belting Co.

Belting.
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Electrician Publishing Co.
Spon & Chamberlain.

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Cables, Electric (See Insulated Wires). Copper Sheet and Bar.
American Elec. Works.
Central Electric Co.
Chicago Insulated Wire Co
Eastern Electric Cable Co
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New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

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Central Electric Co.
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Naugle, Holcomb & Co.
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Hobart Elec. Mfg. Co
Northern Elec Mfg Co.
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Pringle, Wm. T.
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Chicago Insulated Wire Co.
Electric Appliance Co.
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Okonite Co., The.
Paiste Co., H. T.
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Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
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Chicago Insulated Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Leschen-Macomber-Whyte Co.
Montauk Multiph. Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
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Eddy Elec. Mfg. Co.
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General Inc Arc Light Co.
Hobart Elec. Mfg. Co.
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Rawson Electric Co.
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Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Noblett, E. J.

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Splitdorf, C. F.
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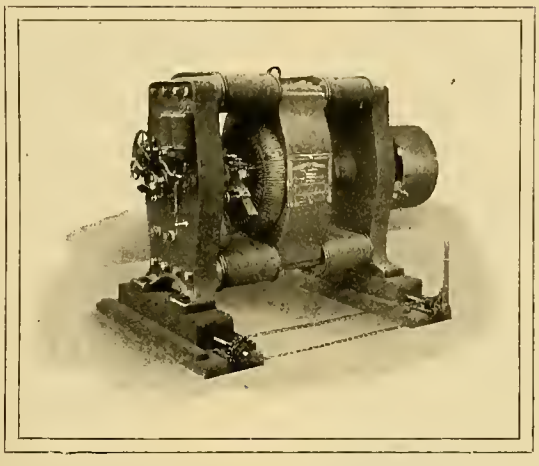
(INCORPORATED)



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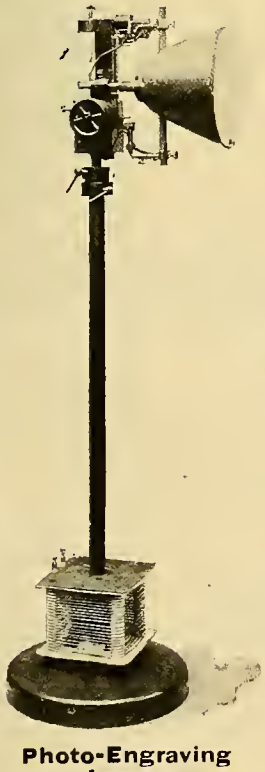

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Let us know your requirements and we can supply your wants.

Petite Alternating Enclosed Long-Burning Arc Lamp.

Adapted for great variations in voltage and frequency. Ordinary changes in voltage and frequency do not produce flickering or unsteadiness of the arc. Standard adjustment 104 volts; with this adjustment the lamps will burn steadily under variations from 90 to 115 volts.

Reasonable cost.
High efficiency.
No framework in sight.
Shade reflects upward rays downward.
For indoor and outdoor use.
Easily trimmed.

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Electric Light and Power Apparatus,
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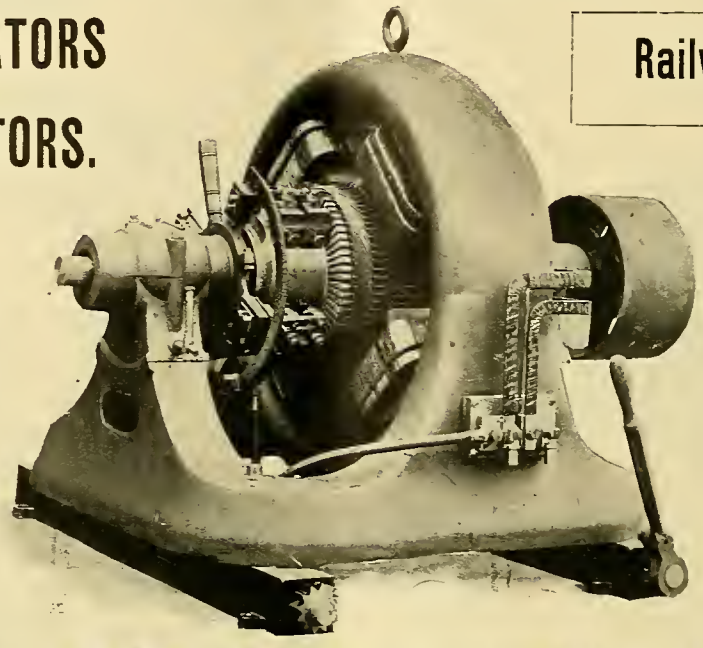
FOUR, SIX AND EIGHT POLE.

Two and Three Bearing, Belted and Direct Connected.



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Necessary for Perfection are found in the

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A specialty of lamps for railway circuits.
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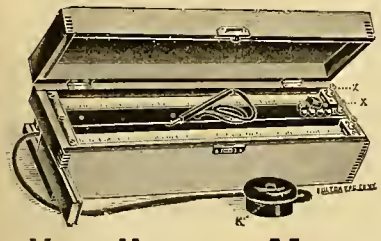

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In a machine shop
Mounted on the ceiling.

What is the Resistance of its Field?

You try with a testing set
And level
And pull plugs
And press keys
And wait for needle to come to rest
And add
And divide
And make mistakes
And swear.

You use a direct-reading ohmmeter and get the results twelve seconds after the connections are made.

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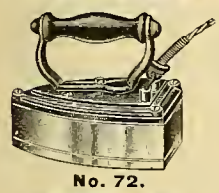

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Weight, 8 lbs
Consumes 550 watts.
Any voltage up to 220.

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Consumes 450 watts.
Any voltage up to 220.

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OUR STUDENTS SUCCEED.

FARMER BECOMES SUPERINTENDENT.

I think there is no better chance to advance than through the Schools. Before I enrolled I was a farmer, and knew practically nothing about electricity or steam engineering. My Courses in Electric Power and Lighting and Stationary Engineering have been a source of great benefit to me, as I now have charge of an electric-light plant, and cheerfully admit that I owe my position and salary to the Schools.

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For some time previous to enrolling in the Schools I had been reading everything I could get pertaining to mechanical and electrical engineering, but found that I needed a better education in mathematics. When I enrolled in the Electrical Engineering Course I was second engineer of the Topeka Railway Company. About one year afterwards, I was promoted to the position of chief engineer at a much larger salary.

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And where is there an electrician that doesn't have them—some pretty bad ones, too? Can be rapidly and permanently cured by one or two applications of Vitogen. Mr. Harry Rood, New Albany, Ind. (electrician), says: "Vitogen saved my life, and I cannot say too much for it." Better keep a bottle handy. It will come in good use when you least expect it. A perfect Antiseptic Dressing Powder.

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Cures Burns, Scalds, Ulcers, Tumors, Blood Poison and Sores.

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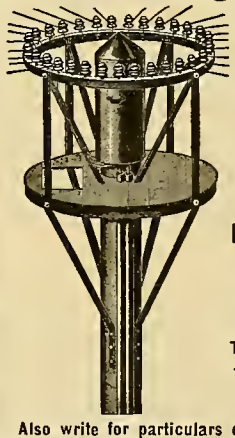

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Special Connectors for BARE or DRAWN COPPER WIRE, all sizes. FUSED WIRE, FUSED LINKS and STEEL.

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Will be good as new if you fix them up RIGHT, and BETTER if you take out old-style clutches and fit them up with the

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The only clutch ever made that can be put in a lamp without taking rods out. We can FIX your T.-H. Lamps and make them better than they ever were.

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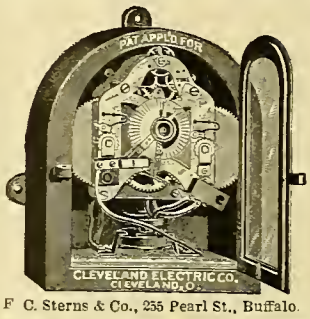

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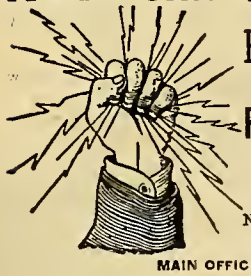

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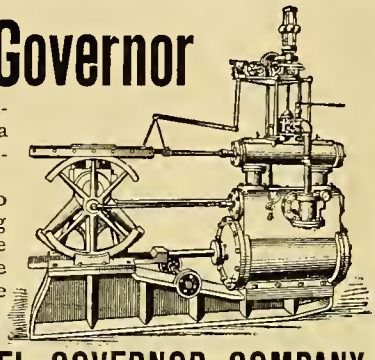

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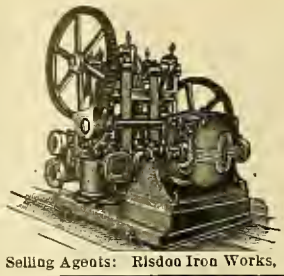

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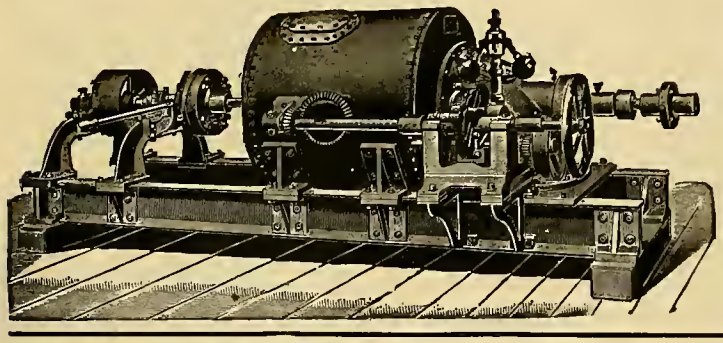

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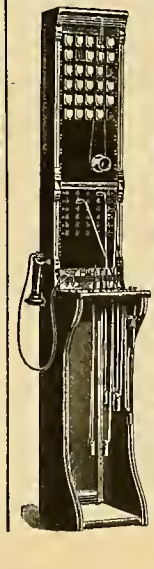

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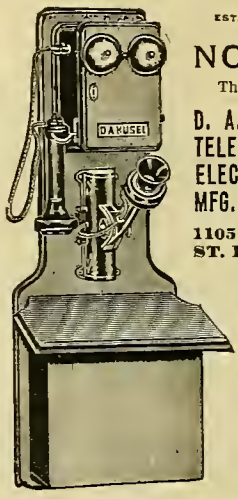

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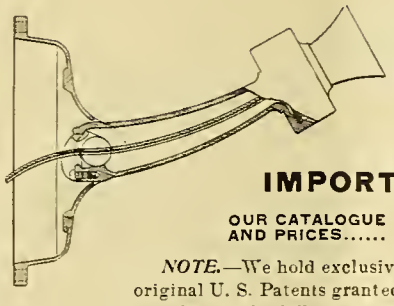

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The Largest Manufacturers of Telephones and Switchboards in the United States.

Seven hundred exchanges aggregating over 300,000 telephones in use. Four years' service.

Write for catalogue showing new types and prices.

WE GUARANTEE Workmanship, material and efficiency of our apparatus to be of the *highest grade*, and agree to defend, at our own expense, any action at law which may be brought against OUR PATRONS on alleged infringement of patents owing to the use of our instruments.

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THIS TRADE MARK
STANDS FOR THE

Best Transmitter

FOR ALL PURPOSES

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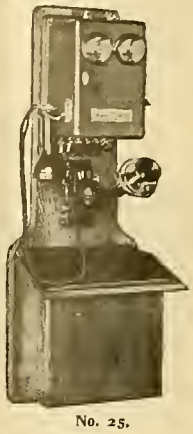
Mason Telephone Pay Stations.
Toll-Line Arrester and Cut-Out Switch.

STANDARD TELEPHONE & ELECTRIC CO.,
MADISON, WIS.

POSITIVELY THE BEST.



No. 25.

We do not manufacture **cheap** apparatus, but have **spared no pains** to make our product not only **attractive in appearance,** but of the **highest degree of perfection,** electrically and mechanically, yet attained. Our efforts have met with the earnest and gratifying support of all who have given our goods a trial.

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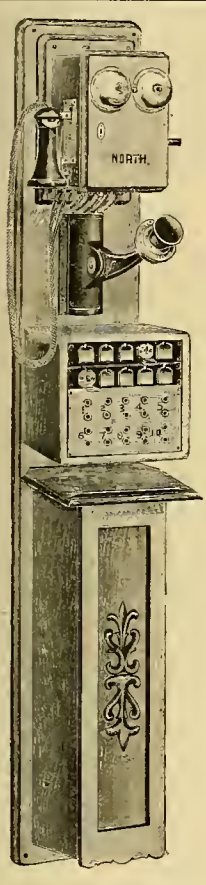
Our Magneto Bells, Receivers, Switchboard Generators and Transmitters Lead the World.

THE WILLIAMS ELECTRIC CO.,
CLEVELAND, OHIO.



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MAY BE INCREASED BY
CONNECTING UP YOUR

FARMERS

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OUTLYING DISTRICTS.

Others are Making their Plants Pay Fair Interest on their Investments that Formerly Showed a Shortage.

NEW FEATURES!

ALL TROUBLE POINTS

ELIMINATED.

No Listening Keys.
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No Complications in Your Cord Circuit.
No Delays—Always Ready for Business.

WE WILL TELL YOU HOW IT'S DONE.
WRITE TO

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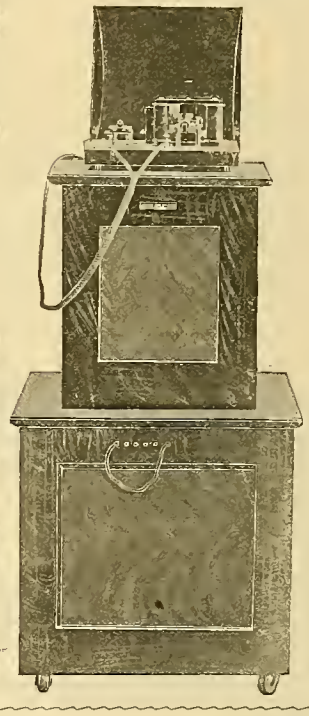
CLEVELAND, 61-73 FRANKFORT ST., OHIO.

The Warner Telephone Generator Cabinet.



SIMPLE, DURABLE, EFFICIENT.

It is rapidly taking the place of the old magneto-generator outfit for ringing subscribers' bells. Is just the thing for selective signal ringing; is furnished fitted with either dry or storage batteries. One set of dry batteries is guaranteed to give 600,000 signals, allowing about five seconds to each signal. It is guaranteed to ring the heaviest loaded toll lines and to do harder work than any magneto made. It is just the thing for exchanges, both large and small. Is the cheapest and most reliable method of obtaining power for this purpose. You cannot afford to be without it. It is fully guaranteed and is sold by all responsible telephone supply houses.

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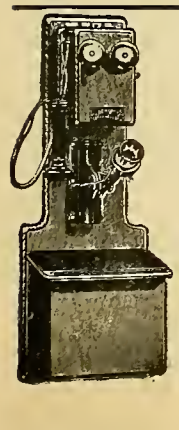

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No competition in talking.
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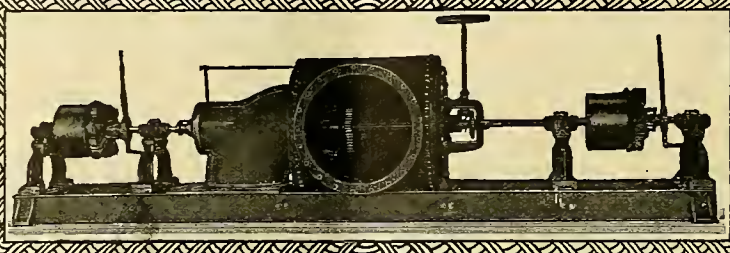

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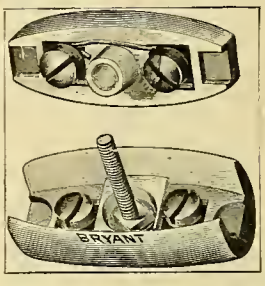

Concave-head contact screws in the base, and convex in the cap, insure a perfect contact where the two connecting wires are of different gauge.
The cover, being held in place by but one nut, can be readily removed for fusing.

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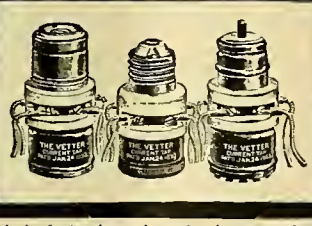
The Vetter Current Tap.
A Tapping Plug and Lamp Socket Combined.



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A new device for lighting Gas or Gasoline Stoves. Safe, convenient and economical. No electric connections required. Always ready for use. Will last a lifetime. AN ORNAMENT TO THE STOVE. Endorsed by leading gas companies.
NO MORE MATCHES for the children to play with.
Price, complete, $2.50
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Double Adjustment
A GOOD CHEAP BELL
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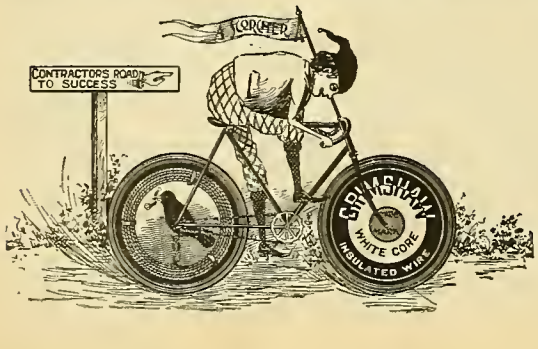

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RAVEN WHITE CORE, RAVEN BLACK CORE, COMPETITION LINE WIRE, GRIMSHAW AND COMPETITION TAPES AND SPLICING COMPOUNDS.
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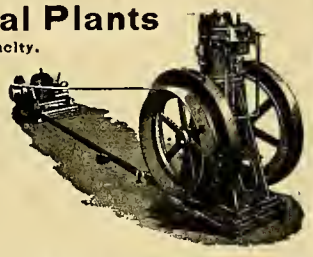

For every five gas jets you now burn you can (with a Gas Engine Plant) obtain ten 16 c. p. incandescent lights.

ABSOLUTELY NO FLUCTUATION.

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For all Heads from 3 Ft. to 2000 Ft.
Especially adapted to all kinds of
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Recent tests at Holyoke enable us to guarantee:
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INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
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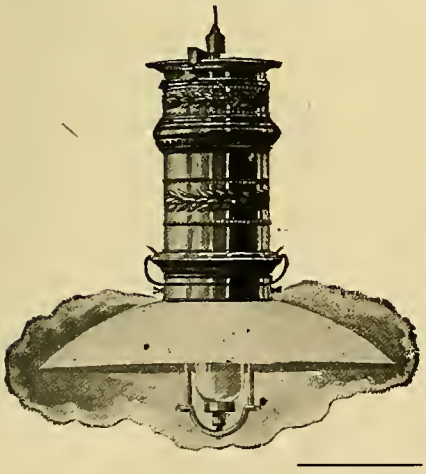
ENCLOSED ARC LAMPS

For Constant Potential Circuits are Superior in Points of



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OPEN OR CLOSED CIRCUIT WORK.

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Will do the work of any two batteries on the market, and can be renewed at the least cost.

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for two and three-wire single-phase and polyphase systems.

Compact, Light, Durable, Accurate, Permanent.

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Characteristics:

Records true energy used whatever the power factor of the circuit.

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Is willing to help you know. The lower line of label reads: "Please note date battery was set up." Warranted superiority of four to one.

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THERE IS NO PAINFUL JAR TO THE FINGER WHEN OPERATING.

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Also in gangs of any number up to eight.

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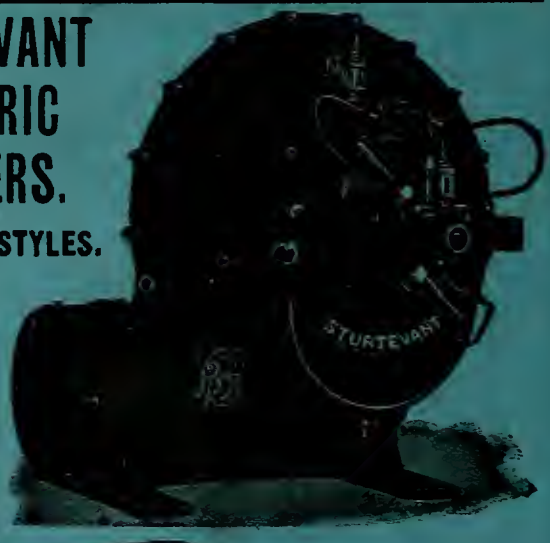
ALL SIZES & STYLES.

GENERATING SETS
1½ to 100 K. W.

ENGINES, MOTORS, ETC.....



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Enclosed Motors,
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Vol. XXV. CHICAGO, SEPTEMBER 23, 1899. No. 13

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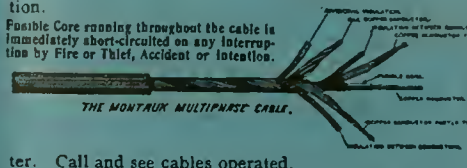

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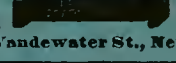
X-Ray Coils, Telephone Coils.  Medical Coils, Spark Coils.

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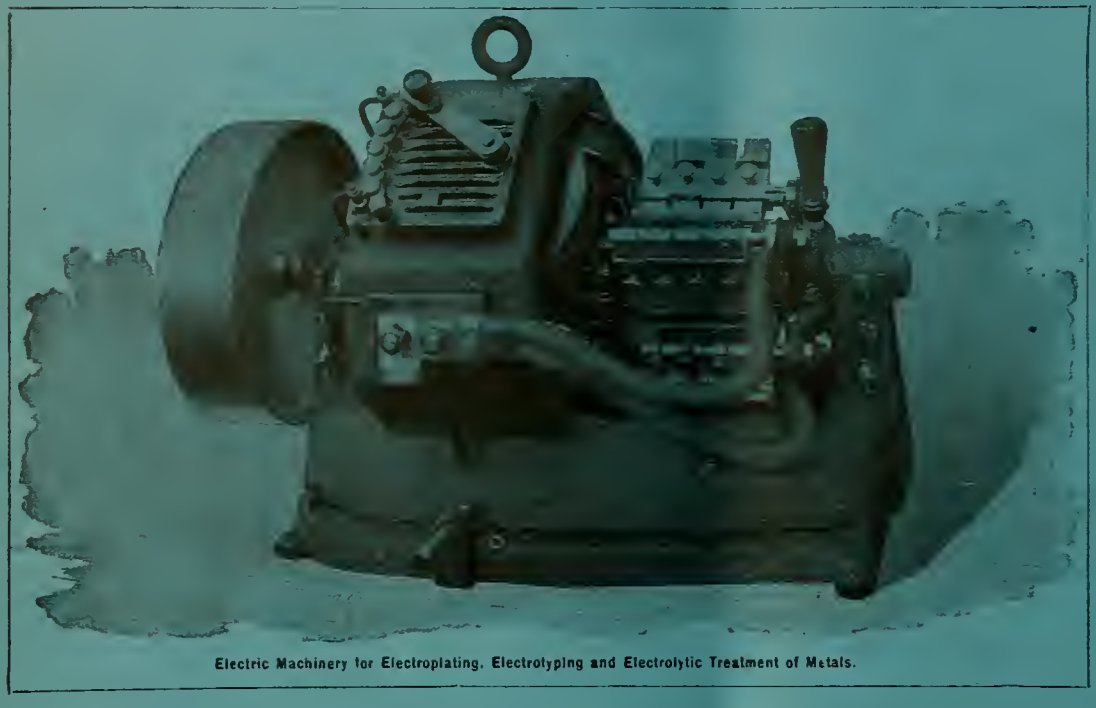

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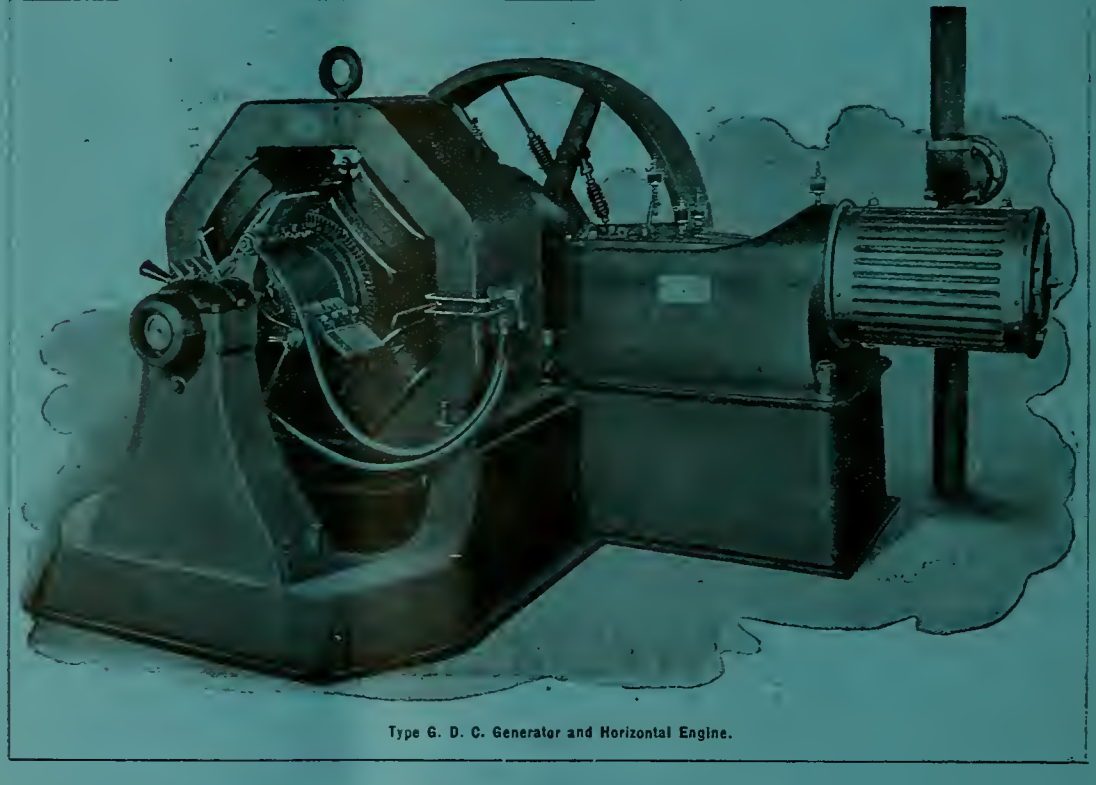

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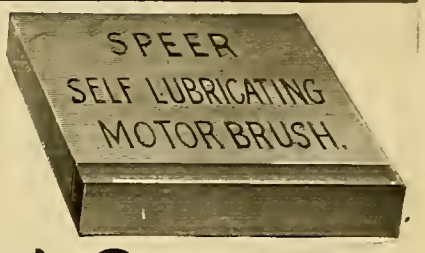

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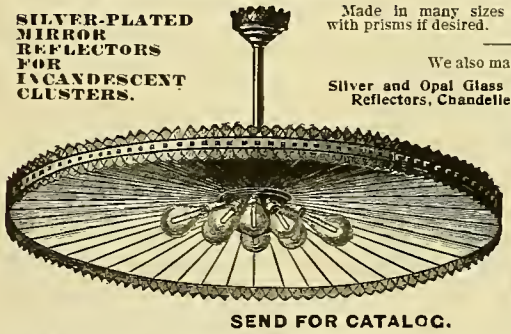

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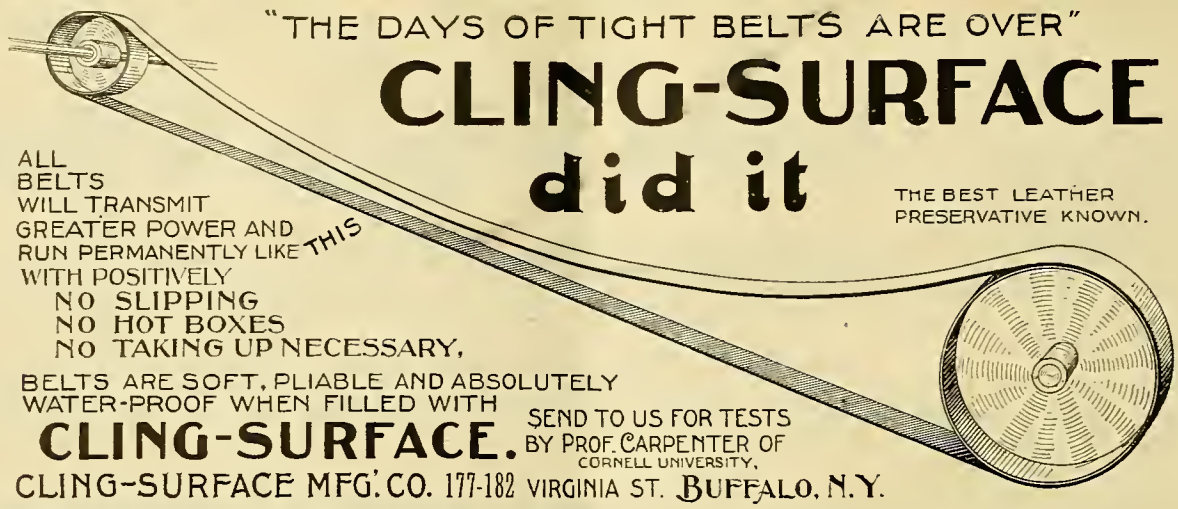

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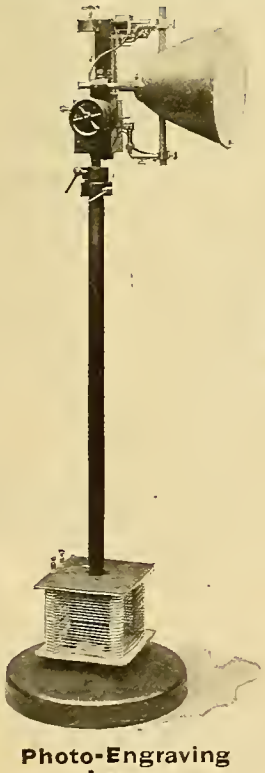

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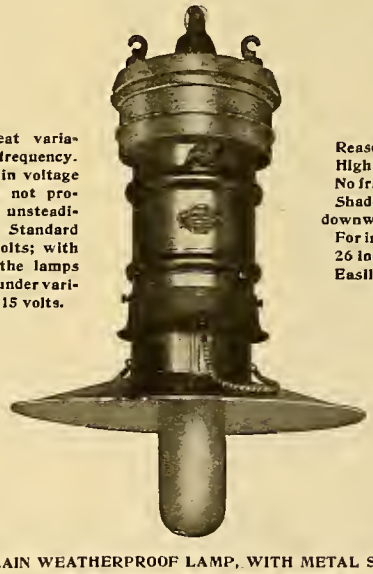

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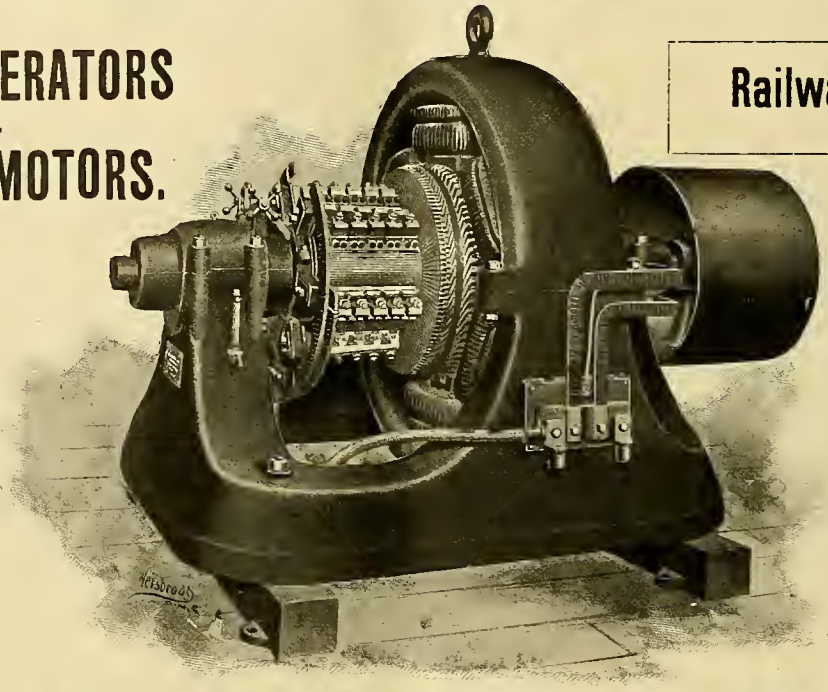

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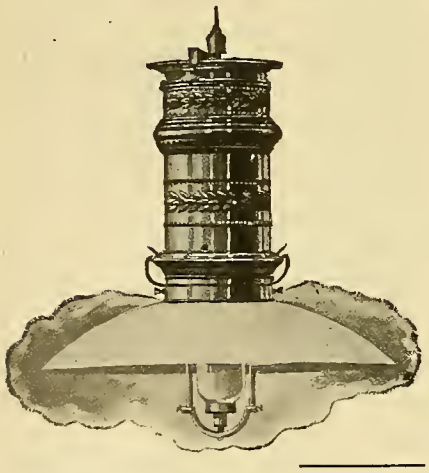

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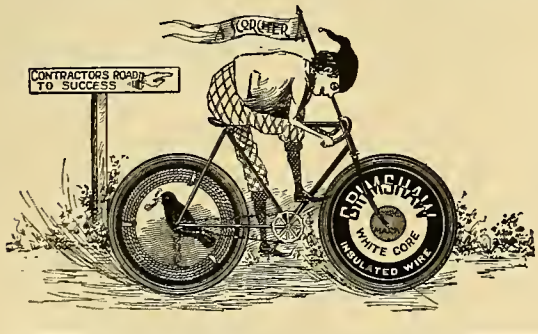

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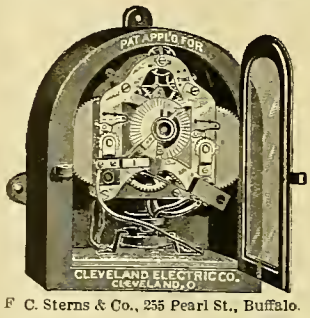

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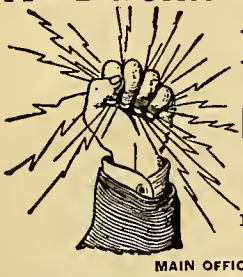

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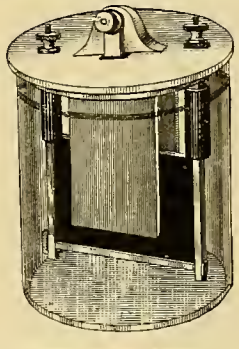

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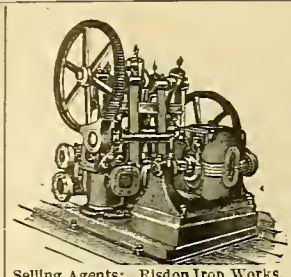

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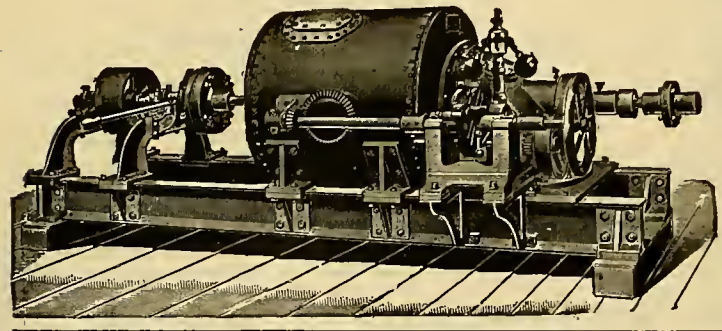

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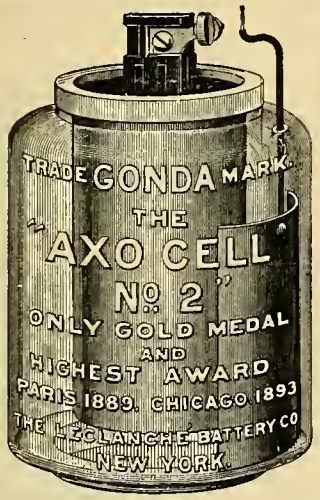

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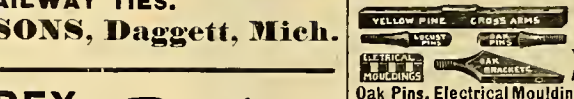

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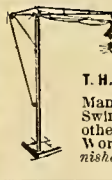

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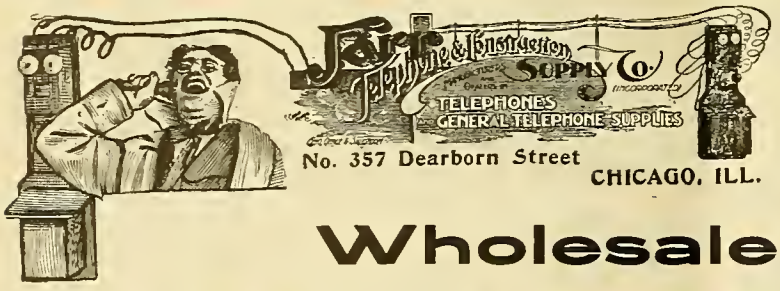

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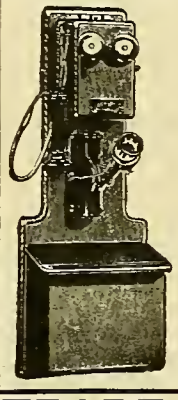

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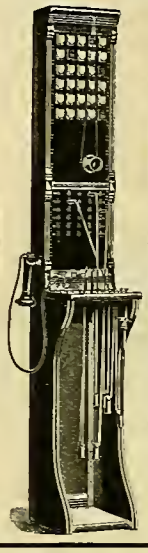

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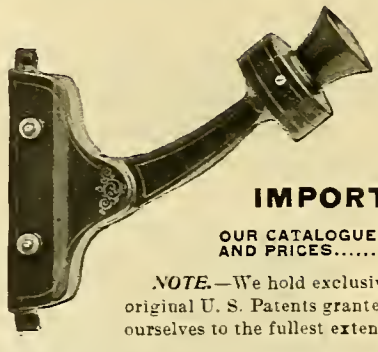

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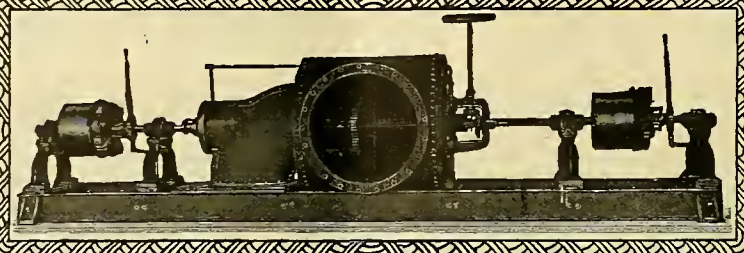

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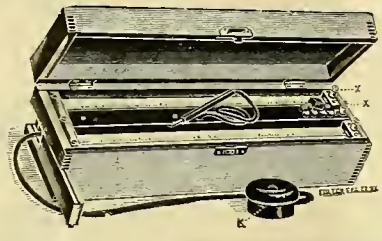

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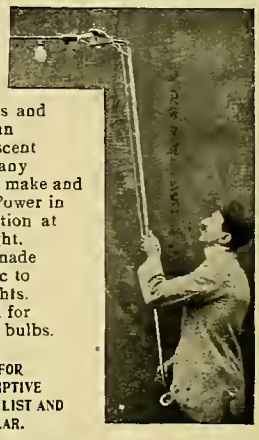

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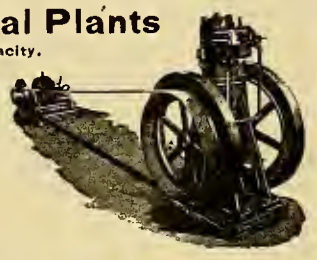

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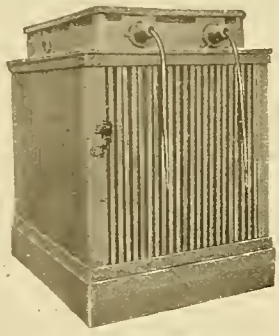

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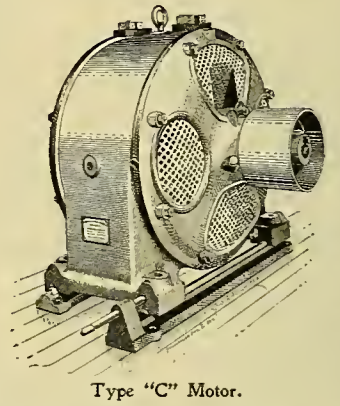

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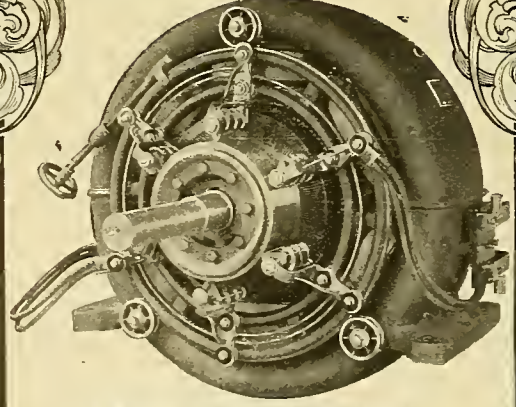

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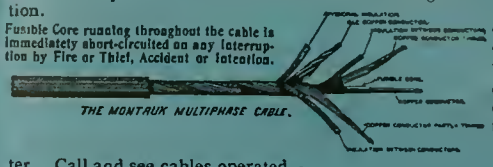
MAIN OFFICE, 124 South Jefferson Ave., PEORIA, ILL.

CHICAGO OFFICE, 321 Dearborn St. DAVENPORT OFFICE, 326 Brady St.

The Only Fire Detective Cable in the World.

Every Fractional Part of which is continuously Thermostatic, and designed for all Interior Electric Wiring Adaptations. It lights the gas! Rings the door bells! It automatically notifies of fire and indicates that burglars are at work, all in one installation.



Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, Accident or Intention.

THE MONTAUK MULTIPHASE CABLE.

Why use dormant wires? The Montauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human being is to the touch of flame.

Write for descriptive matter. Call and see cables operated.

MONTAUK MULTIPHASE CABLE CO.,

Telephone 4031 Cortlandt. 100 Broadway, NEW YORK.

2,000 IN USE.

Bipolar and Multipolar Motors from ¼ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

Queen & Co.,

1012 Chestnut St., PHILADELPHIA.

Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils

C. F. SPLITDORF,

X-Ray Coils, Telephone Coils. Medical Coils, Spark Coils.

17-27 Vandewater St., New York.

THE **PHOENIX GLASS CO.**

MANUFACTURERS OF

GAS AND ELECTRIC GLOBES, SHADES, Etc.

HAVE YOU A COPY OF OUR No. 8 CATALOGUE? IF NOT, SEND FOR IT.

Pittsburgh. New York. Chicago.

Chicago Belting Company

MAKERS OF LEATHER BELTING RELIANCE DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

The production of our Dynamo brand of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and in all climates.

When ordering Dynamo Belting always state the system used.

OFFICE AND FACTORY 67-69 SOUTH CANAL STREET CHICAGO, ILL.

NEW ORLEANS ST. LOUIS MINNEAPOLIS

I-T-E

CIRCUIT BREAKERS

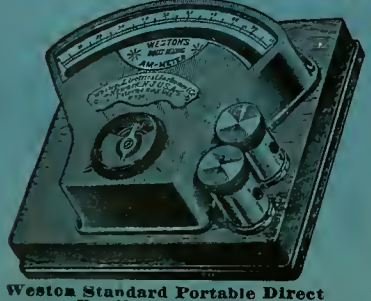
CUTTER ELECTRICAL CO., PHILADELPHIA

WESTON Electrical Instrument Co.,

114-120 William St., NEWARK, N. J., U. S. A.

Weston Standard Portable Direct Reading

Voltmeters, Millivoltmeters, Voltammeters, Ammeters, Milliammeters, Ground Detectors and Circuit Testers, Ohmmeters, Portable Galvanometers.

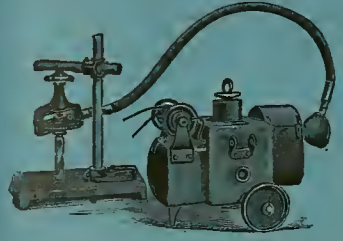


Weston Standard Portable Direct

Our Portable Instruments are recognized as The Standard the world over. The Semi-Portable Laboratory Standards are still better.

Our Station Voltmeters and Ammeters are unsurpassed in point of extreme accuracy and lowest consumption of energy.

Mention the WESTERN ELECTRICIAN when writing.



ESTABLISHED 1875.

COMBINATION OF

Stow Flexible Shaft

AND

MULTI-SPEED MOTOR.

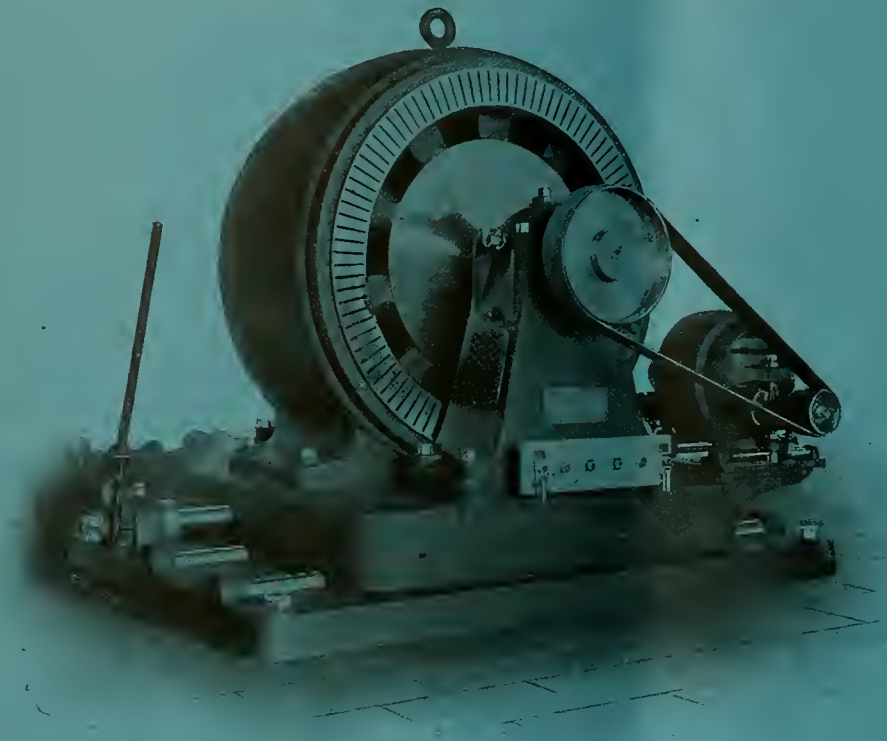
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.

Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England.

Western Electrical Supply Co.,

10 and 12 North 9th Street, ST. LOUIS, MO.



150 K. W. Warren Alte nator.

Exclusive Territorial Agents for

The Improved Warren Alternator.

No Moving Wire.
No Collector Rings.
No Commutator.
No Brushes.

ADAMS-BAGNALL ENCLOSED ARC LAMPS

For Direct and Alternating Current.

PERFECT IN RECULATION.
SIMPLE IN CONSTRUCTION.
EASY TO TRIM. LONG LIFE.

Prompt Shipments from St. Louis Stock.

Western Electrical Supply Co.,

Manufacturers, Jobbers and Dealers in
"Everything Electrical."

The First Edison Company to Use the Chloride Accumulator

—WAS THE—

EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK,

Whose First Battery was Contracted for in 1894. It now has Five Batteries upon its System and has Recently Contracted for EIGHT ADDITIONAL BATTERIES, a Total of Thirteen Plants, having an Aggregate Capacity of 104,000 Ampere Hours at 130 Volts.

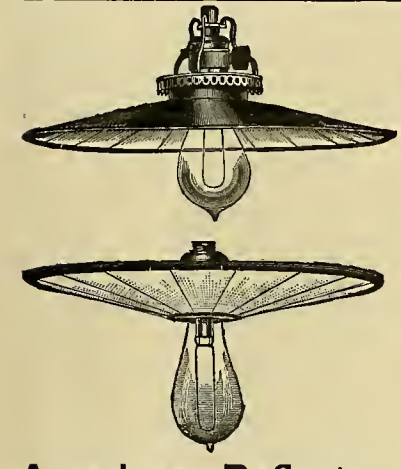
OTHER RECENT SALES OF THE CHLORIDE ACCUMULATOR FOR CENTRAL STATION SERVICE:

Chicago Edison Company, Two Batteries; Columbus, O., Edison Electric Light Co., One Battery; Minneapolis General Electric Co., One Battery.

ELECTRIC STORAGE BATTERY CO., PHILADELPHIA, PA.

SALES OFFICES:

New York, 100 Broadway. Boston, 60 State St. Baltimore, Equitable Building. Cleveland, New England Building. Chicago, Marquette Building. San Francisco, The Parrott Building.



SILVER-PLATED MIRROR REFLECTORS.

A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

GET OUR PRICES.

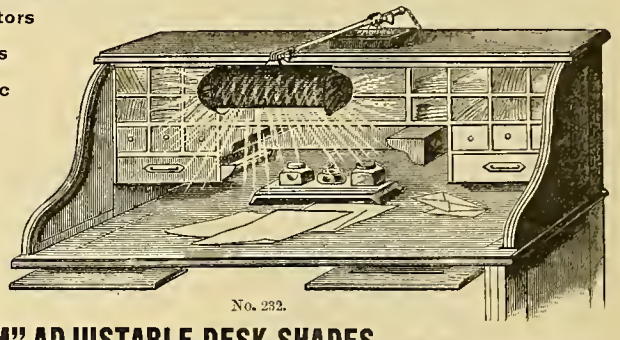
American Reflector & Lighting Co.,

271-273 FRANKLIN STREET, CHICAGO.

KLEMM & CO.,

N. W. Cor. 5th and Cherry Sts., Philadelphia.

Reflectors and Shades for Electric Light.



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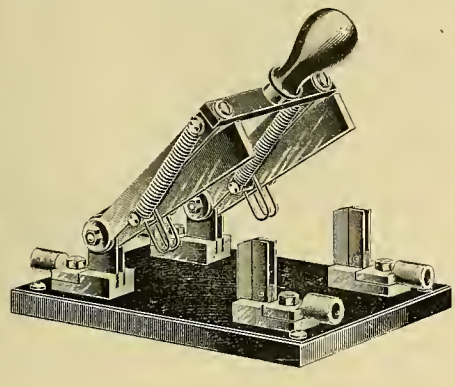
"KLEMM" ADJUSTABLE DESK SHADES, the best in the market.

"KLEMM" PATENT ADJUSTABLE REFLECTOR, cheapest and best Reflector for lighting Show Windows and Art Galleries.

Send for Catalogue of Reflectors for Stores, Churches and general purposes.



KNIFE SWITCHES.

Stock sizes comprise Quick and Ordinary Break—Single and Double Throw—Single, Double and Triple Pole—Front and Back Connections—Range of Ampere Capacity Sufficient to cover all the usual needs.

Central Electric Company,

264, 266, 268, 270 FIFTH AVENUE, CHICAGO.

OKONITE IT NEVER DISAPPOINTS

Southern Electrical Supply Co., St. Louis.

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CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

HARDY

LAMPS Uniform in Candle Power. Uniform in Watts per candle. Prices right. Prompt shipments.

LAMP COMPANY, - PITTSFIELD, MASS.

STEREOPTICONS MAGIC LANTERNS and SLIDES CONDENSED CATALOGUE FREE RILEY BROS. 16 BEEKMAN ST. NEW YORK.

LONDON. PARIS.

MONA COMMUTATOR COMPOUND,

TROTTER'S COMMUTATOR COMPOUND NEW YORK

The most efficient lubricator, is the only article that is guaranteed to stop sparking. It can be used on leaf, carbon or gauze wire brushes with the greatest safety. Puts a beautiful luster on the Commutator. Does away with the use of sandpaper or any other material that wears out or destroys its surface. It is the largest and most economical stick manufactured. It comes in two sizes. Small size, $3.00 per dozen. Large size, $5.00. Samples mailed free on application. For sale by all supply houses throughout the United States, England and Canada.

Manufactured only by TROTTER'S MONA MFG. CO., Ltd., No. 65 West Broadway, New York City.
Messrs. GOLOMARK & WALLACE are the Sole Agents for the United States 121 Worth St., New York City.
SATISFACTION GUARANTEED OR MONEY REFUNDED.

THE LEA

Enclosed Arc Lamp.

Direct and Alternating.

Permanent Alignment,
High Efficiency,
Accessibility.

Handsome Fall Catalogue, Showing new features and Designs now ready. It is worth sending for.

Lea Manufacturing Co.
ELWOOD, IND.

PERFECTION.

PERFECTION.

OPEN OR CLOSED CIRCUIT WORK.

Electric Generator In a 6x8 Glass Jar.

E. M. F.—2 Volts. CURRENT—12 Amperes. CAPACITY—300 Ampere-Hours.

Will do the work of any two batteries on the market, and can be renewed at the least cost.

For Signal Service, Long-Distance Telephones, Gas Engines, Etc.

PHOENIX BATTERY MFG. CO., ST. LOUIS, MO.

EDDY GENERATORS

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We make a specialty of apparatus for the transmission of Electrical Power through factory or other buildings.

The EDDY ELECTRIC MFG. CO., Windsor, Conn.

CHICAGO, 937-938 Marquette Building.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
ELMIRA, S. N. Blake.
SAN FRANCISCO, CAL., California Elec. Works, 400 Market St.
NEW YORK OFFICE, Singer Bldg., 149 Broadway.
BOSTON, G. M. Angier & Co., 64 Federal St.
ST. LOUIS, Western Electrical Supply Co.
CINCINNATI, Nevada Bldg. John A. Stewart.

THE BULLOCK ELECTRIC MFG COMPANY

CINCINNATI OHIO

SEND FOR BULLETIN NO. 2234.

85 8-'99

WARD LEONARD

Rheostats

AND

Circuit Breakers

ARE THE

"U. S. NAVY STANDARD."

THIS MEANS THAT THEY ARE

THE BEST IN THE WORLD.

Send for our Several New Reduced Price Lists Issued in July and August, 1899.

WARD LEONARD ELECTRIC CO., BRONXVILLE, N.Y., U. S. A.

CARBON

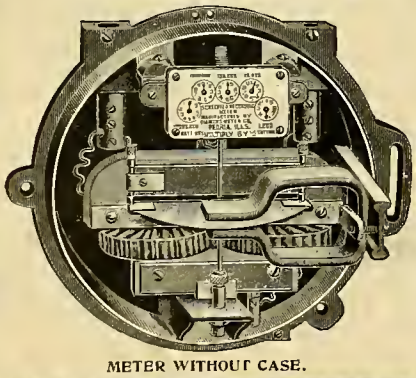
MOTOR AND GENERATOR BRUSHES.

SPEER CARBON CO.,

Andrew Kaul, Pres. Louis Strenber, Vice-Pres.
Andrew Kaul, Jr., Secy. and Treas. J. S. Speer, Gen'l Mgr.

ST. MARYS, PA.

SCHEEFFER RECORDING WATT-METERS.

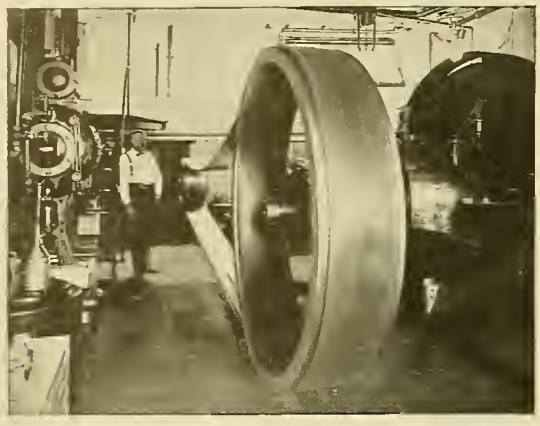


METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,
PEORIA, ILL., U. S. A.

METER WITH CASE.



BROWN, DURRELL & CO.

Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 18-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

Four Months Ago

This belt was as tight as a fiddle string, under about 1,000 lbs. initial tension, and yet was slipping. There is no slip now, for it runs slack. **CLING-SURFACE** did it.

CLING-SURFACE MFG. CO.,

177-182 Virginia Street,

CHICAGO BRANCH, 225 DEARBORN ST. BUFFALO, N. Y.

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Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

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Electrician Publishing Co.
Spon & Chamberlain.

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Central Electric Co.
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Holmes Fibra-Graphite Co.
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Burglar Alarms.
Central Electric Co.
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Cables (See Insulated Wires.)

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Mass. Chemical Co.
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Standard Paint Co.
Trotter's Mona Mfg Co., Ltd.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Central Electric Co.
Electric Appliance Co.
Western Elect. Supply Co.

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Chicago Edison Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
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Western Elect. Supply Co.

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Gates & Randolph.
General Electric Co.
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Bryan & Humphrey.
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Paiste Co., H. T.
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Standard Underground C. Co.
Sterling Varnish Co.
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Western Elect. Supply Co.
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Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
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Okonite Co., The.
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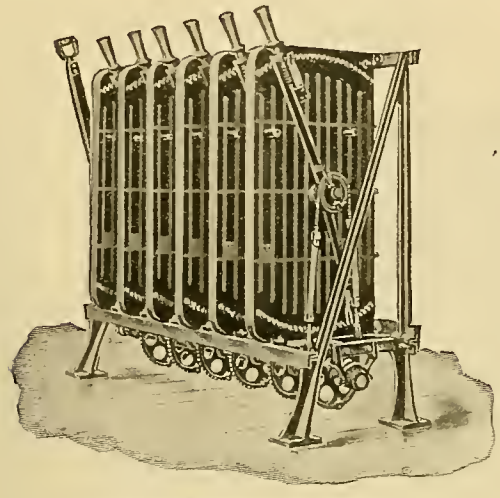
For All Circuits, Alternating or Direct Current,



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...ARE...

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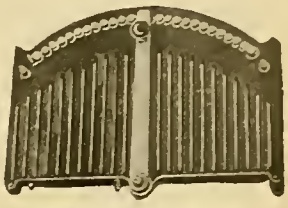
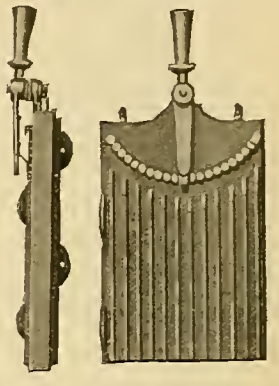


Type No. 7 Dimmers.



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Manufacturers of **RHEOSTATS AND RESISTANCE PLATES** to meet all conditions of practice.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

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Petite Alternating Enclosed Long-Burning Arc Lamp.

Adapted for great variations in voltage and frequency. Ordinary changes in voltage and frequency do not produce flickering or unsteadiness of the arc. Standard adjustment 104 volts; with this adjustment the lamps will burn steadily under variations from 90 to 115 volts.

Reasonable cost.
High efficiency.
No framework in sight.
Shade reflects upward rays downward.
For indoor and outdoor use.
Easily trimmed.

PLAIN WEATHERPROOF LAMP, WITH INNER ENCLOSING GLOBE L AND OUTER ENCLOSING GLOBE S.

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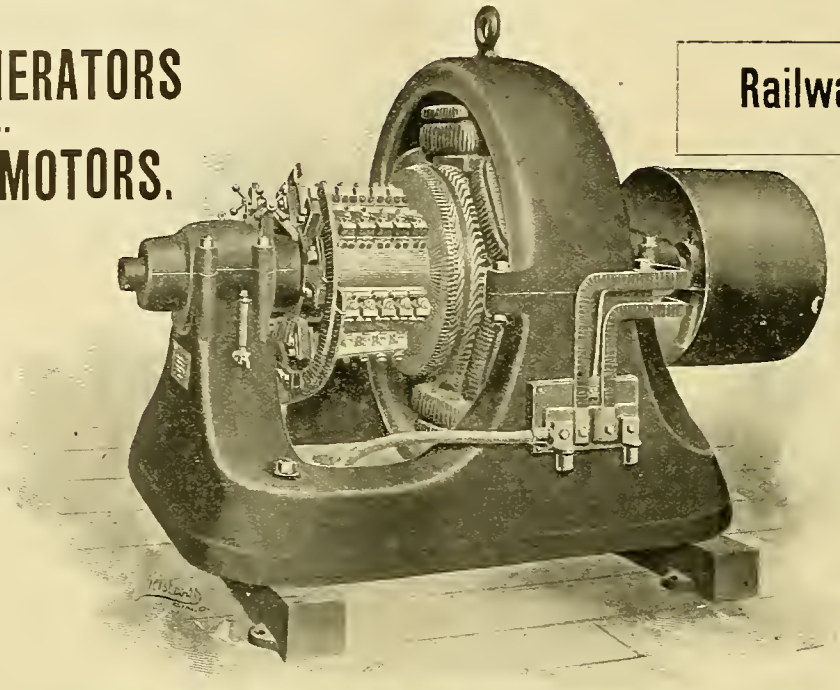
RAILWAY GENERATORS ....AND.... STATIONARY MOTORS.

FOUR, SIX AND EIGHT POLE.

Two and Three Bearing, Belted and Direct Connected.



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LIGHT, HEAT, POWER, AND ELECTRICAL CONSTRUCTION
112 W. CH. AVENUE.

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Gentlemen:--

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The Motors have given absolutely no trouble, and have required no particular attention on our part.

The minimum cost, and convenience of installation on ordinary single phase lighting circuits, fed by a common transformer system, is to be commended.

Yours truly,
THE YOUNGSTOWN ELECTRIC LIGHT CO.,
J. H. Perkins
Ass't Gen'l Manager.

ALSO GET OUR BULLETIN No. 26 ON THIS SAME SUBJECT. . . . . .

WRITE FOR COPY OF A VERY FULL DISCUSSION OF THE SUBJECT OF "THE SINGLE-PHASE MOTOR," PRESENTED TO THE STUDENTS OF ONE OF OUR LEADING TECHNICAL SCHOOLS IN LECTURE FORM, WHICH WE ARE JUST ISSUING IN PAMPHLET FORM. . . .

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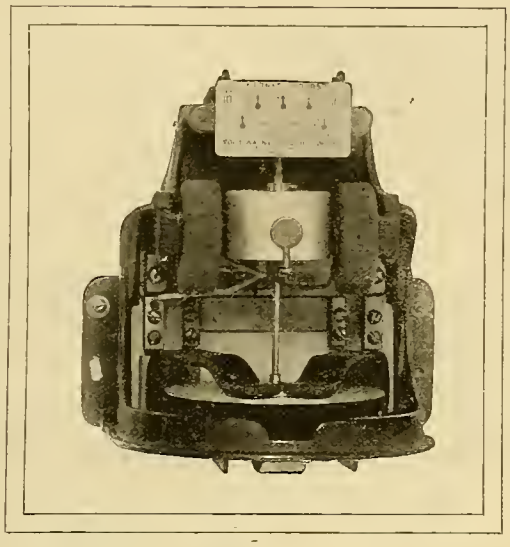
(INCORPORATED)



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Register accurately from 1-100 of full load to 50 per cent. overload.

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MAIL ORDERS WILL RECEIVE SPECIAL ATTENTION AND BE SHIPPED PROMPTLY.

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This Stands for VICTOR Trade Mark. High Grade Goods.

¼ H. P. TYPE ¼ H. P. TYPE

We make a complete line of small motors from 1-12 to 1 H. P. and it will certainly pay you to look us up when in the market for small motors. We also make Dental Engines, Rotary Transformers, Electrical Specialties for Physicians, Surgeons and Dentists. Send for Catalogue.

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CONNECTORS AND TERMINALS.
Special Connectors for HARD-DRAWN COPPER WIRE, all sizes. FUSED WIRE, FUSE LINKS and STRIPS.
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OUR STUDENTS SUCCEED.

FARMER BECOMES SUPERINTENDENT.

I think there is no better chance to advance than through the Schools. Before I enrolled I was a farmer, and knew practically nothing about electricity or steam engineering. My Courses in Electric Power and Lighting and Stationary Engineering have been a source of great benefit to me, as I now have charge of an electric-light plant, and cheerfully admit that I owe my position and salary to the Schools.

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For some time previous to enrolling in the Schools I had been reading everything I could get pertaining to mechanical and electrical engineering, but found that I needed a better education in mathematics. When I enrolled in the Electrical Engineering Course I was second engineer of the Topeka Railway Company. About one year afterwards, I was promoted to the position of chief engineer at a much larger salary.

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dealers in everything electrical. Originators of the prompt shipment idea. Standard material at lowest market prices.

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A COMMUTATOR NECESSITY!

50 CENTS PER STICK. $5.00 PER DOZEN.
Upon Receipt of this COUPON we will Send FREE, Sample Stick.

Name .....
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The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

ABSOLUTELY WILL NOT GUM THE BRUSHES....

It will put that high gloss on the commutator you have so long sought after.

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Sole Manufacturers,
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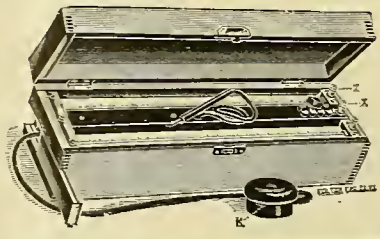

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Quickly and Accurately

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REGISTERED.

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Consumes 550 watts.
Any voltage up to 220.

No. 72.

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Consumes 450 watts.
Any voltage up to 220.

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AMERICAN ELECTRICAL HEATER CO.,
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Double Adjustment
A GOOD CHEAP BELL
HUEBEL & MANGER,
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IN the development of electric heating apparatus for industrial work, we have brought out a small stove 4¾ inches diameter, which is a marked improvement in this line.

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Will be good as new if you fix them up RIGHT, and BETTER if you take out old-style clutches and fit them up with the

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The only clutch ever made that can be put in a lamp without taking rods out. We can FIX your T.-H. Lamps and make them better than they ever were.

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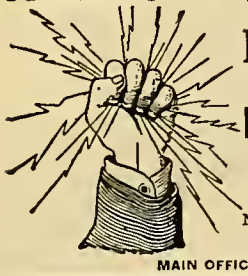

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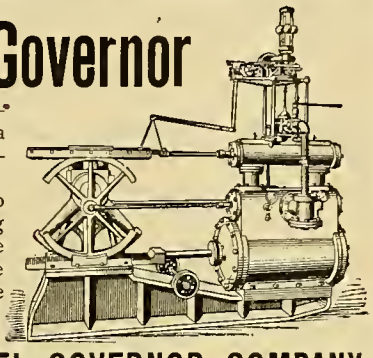

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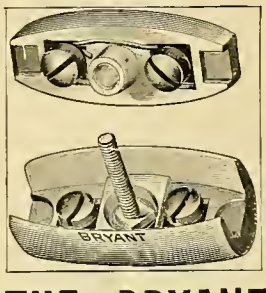

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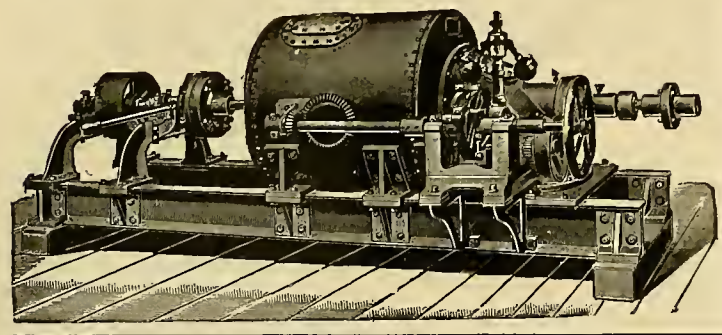

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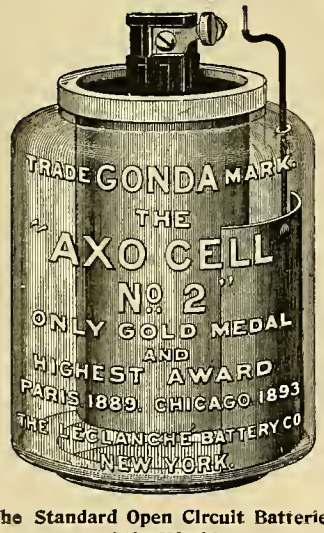

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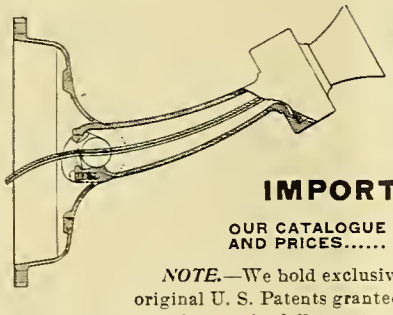

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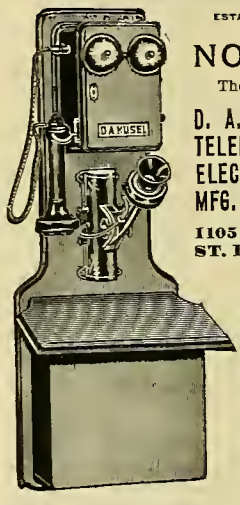

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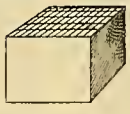

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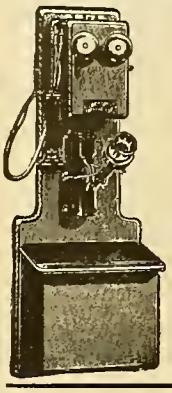

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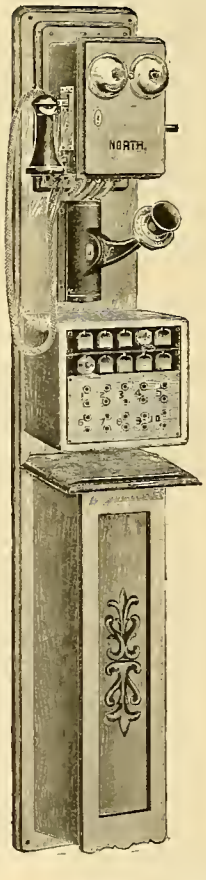

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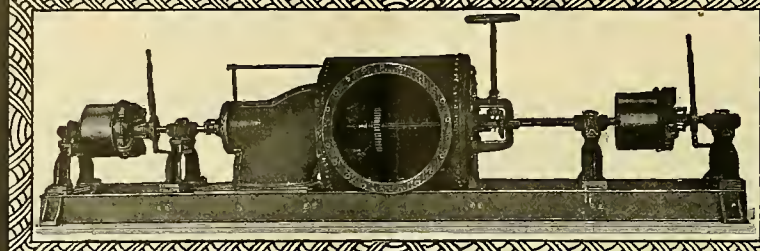

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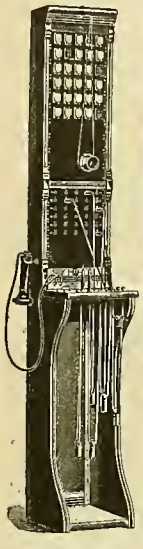

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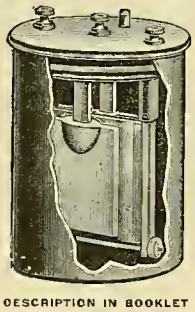

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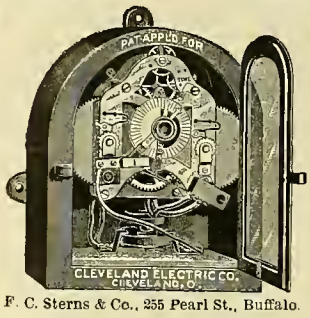

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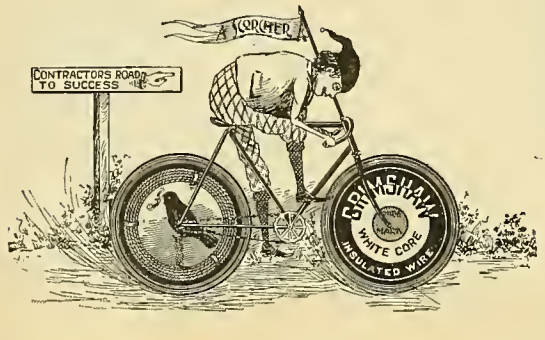

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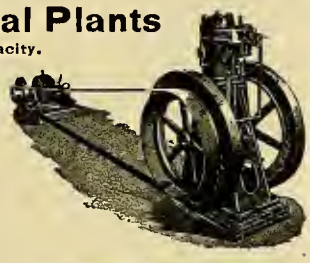

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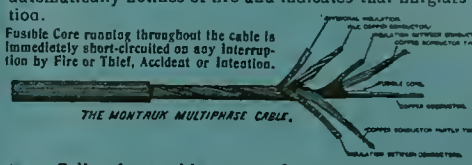

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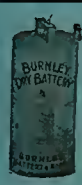

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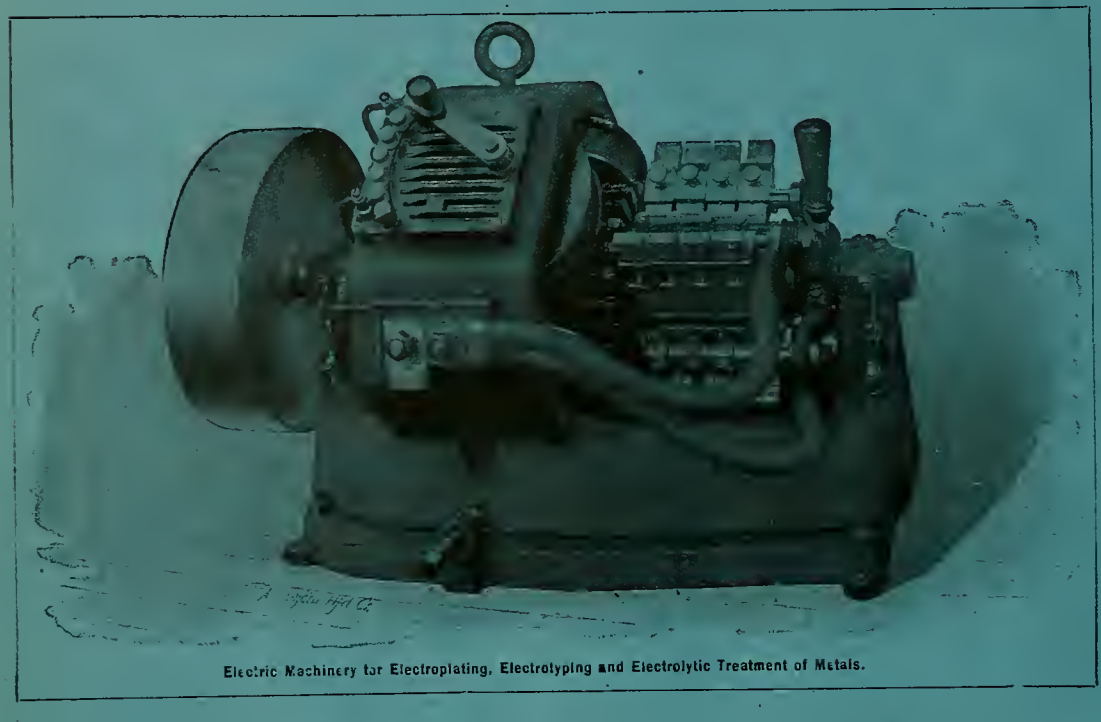

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Medium or Slow Speed.

EDDY DIRECT CONNECTED GENERATORS

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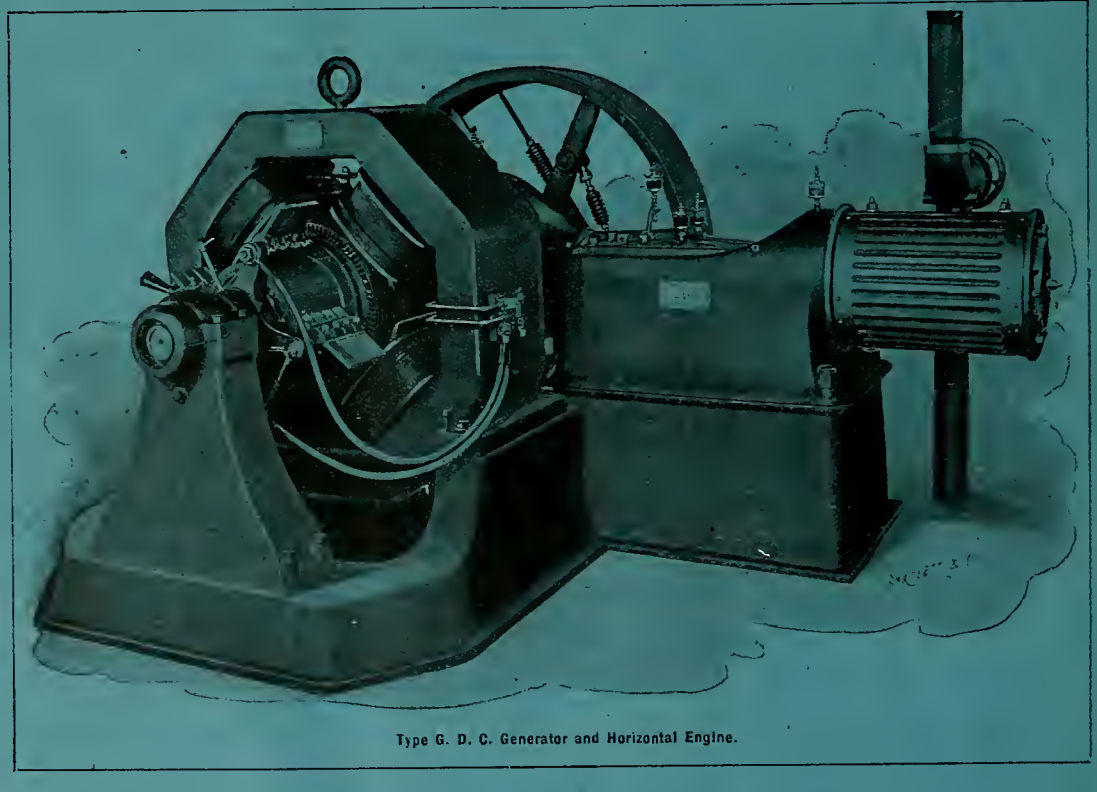

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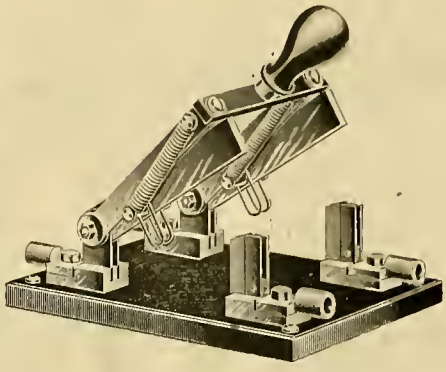
ST. LOUIS, Western Electrical Supply Co.
SAN FRANCISCO, CAL., California Elec. Works, 409 Market St.
CINCINNATI, Nevada Bldg., John A. Stewart.
KANSAS CITY, E. M. Reed & Co.



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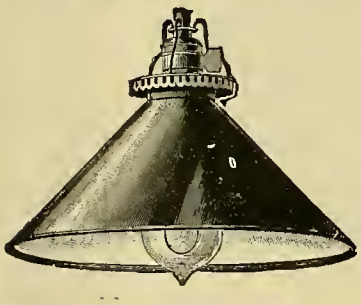

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In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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Will do the work of any two batteries on the market, and can be renewed at the least cost.

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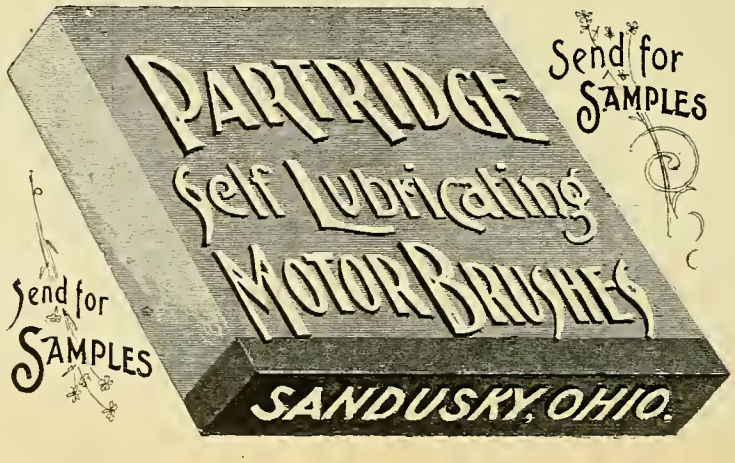

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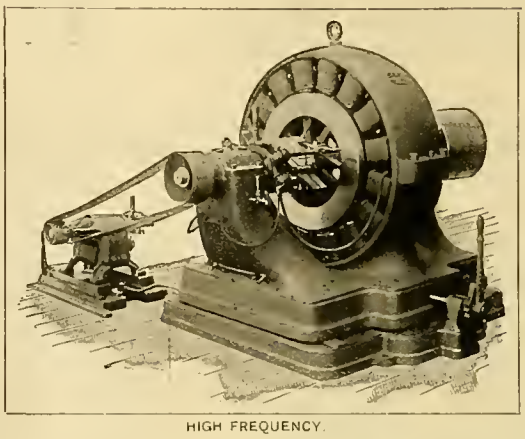

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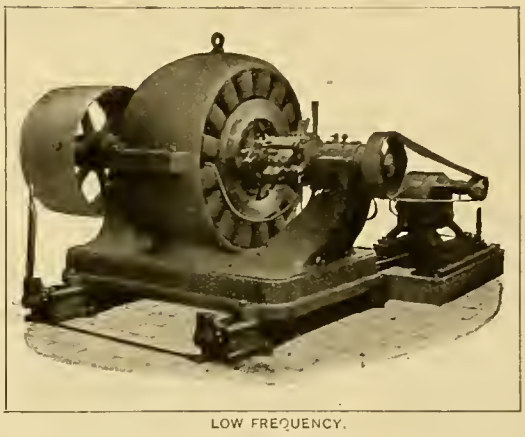

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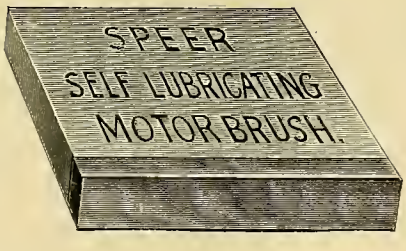

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Queen & Co.
Rolfe Electric Co.
S. E. I. Co.
Siemens & Halske Electric Co. of America.
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Pringle, Wm. T.
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Stow Mfg. Co.

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Rolfe Electric Co.

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Peru Elec. Mfg. Co.
Towle, Geo. C., Mfg. Co.
Victor Electric Co.
Western Electric Co.
Western Elect. Supply Co.

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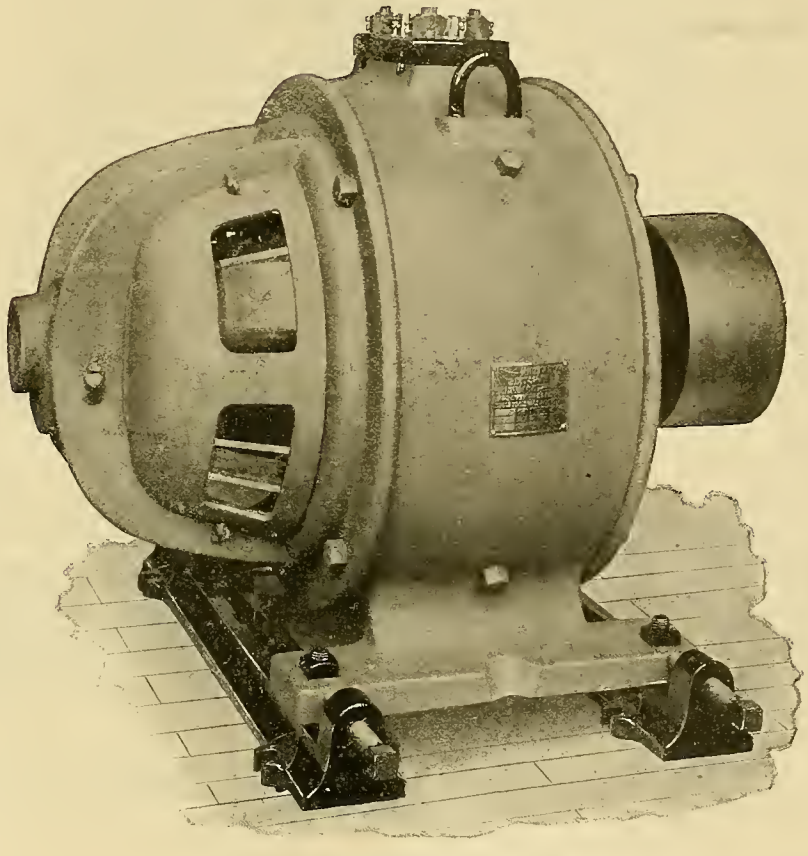

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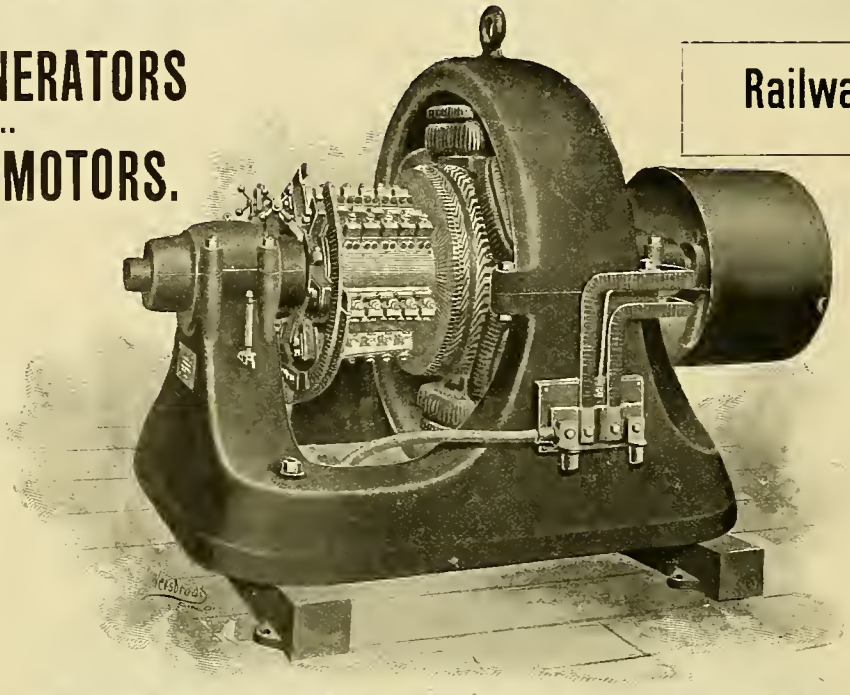

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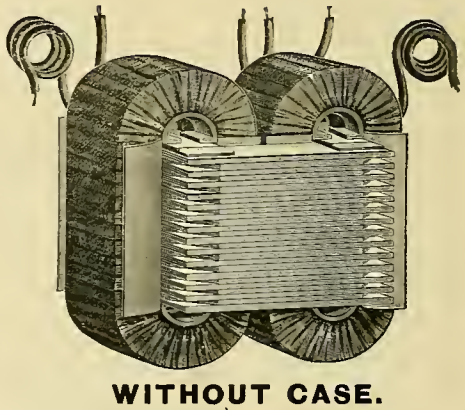

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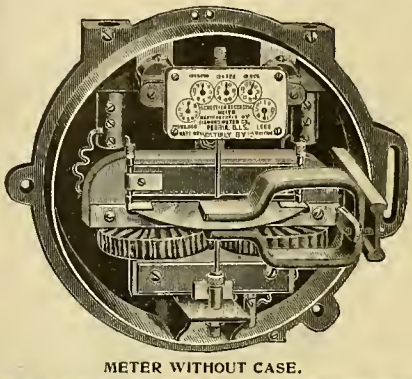

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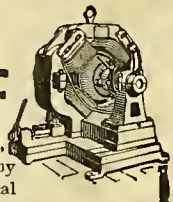

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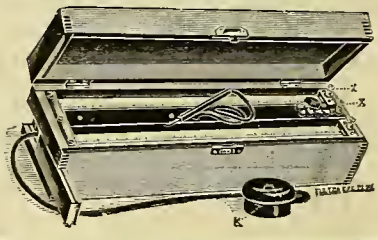

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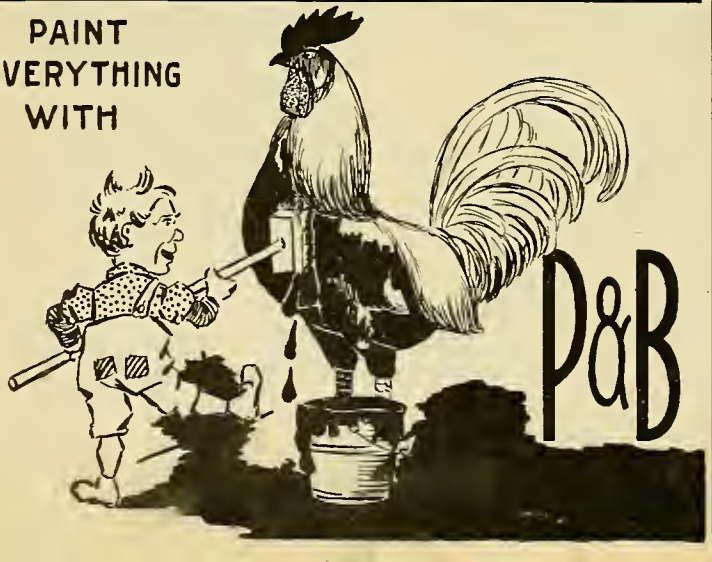

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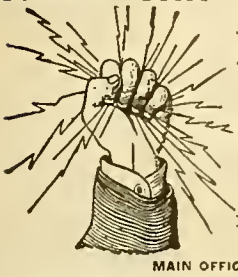

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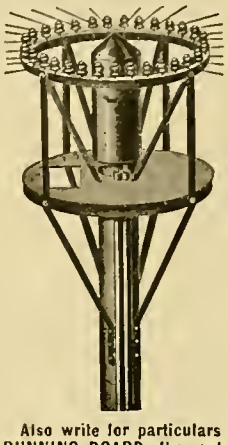

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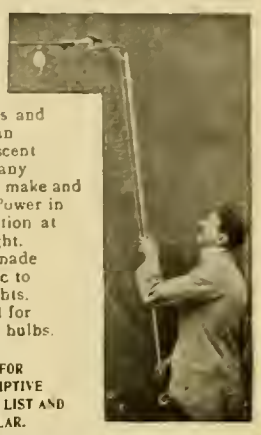

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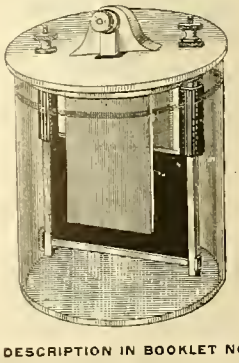

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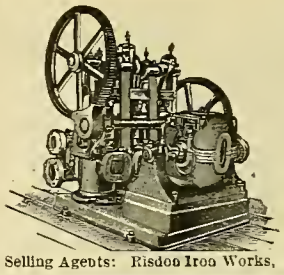

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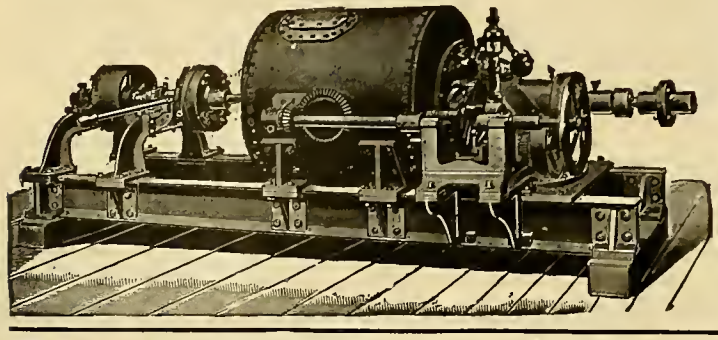

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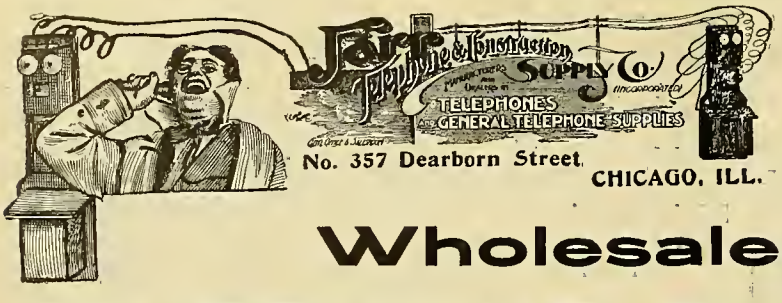

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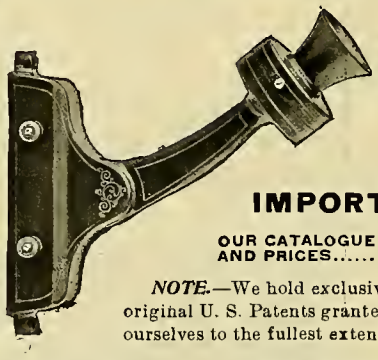

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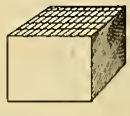

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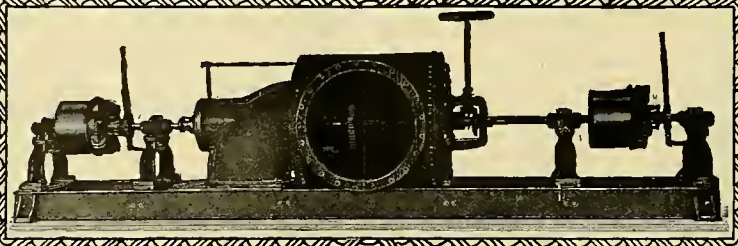

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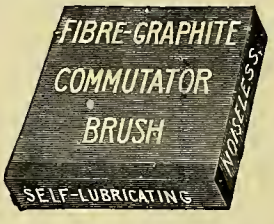

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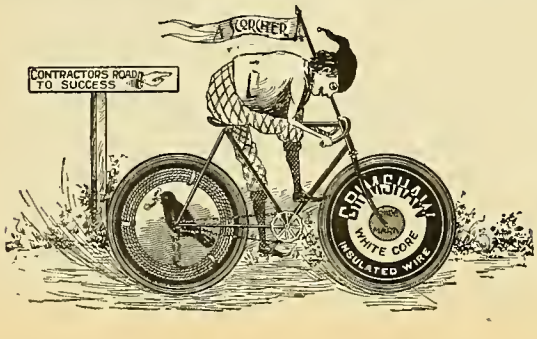

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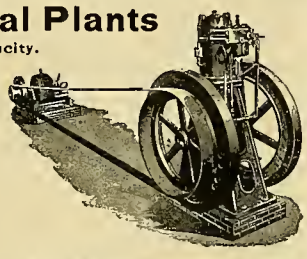

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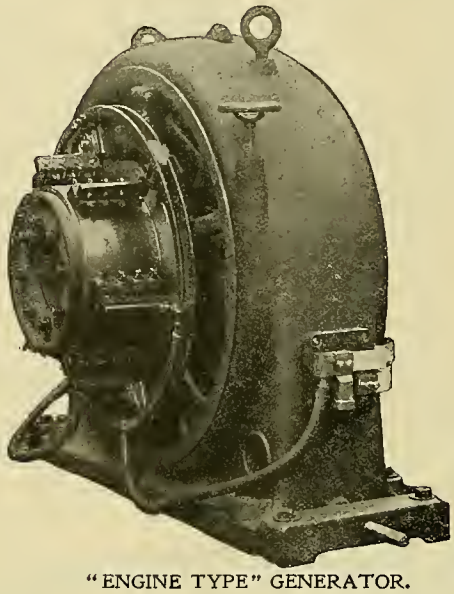

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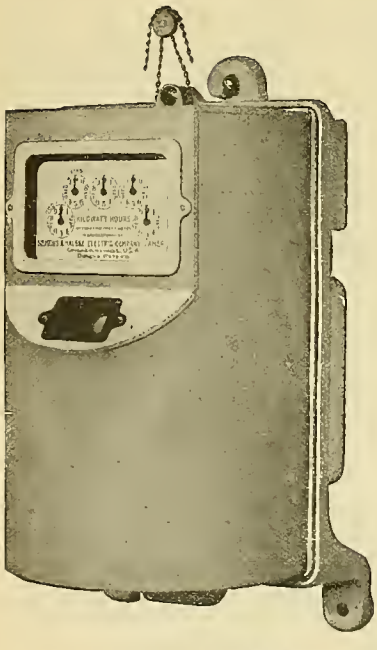

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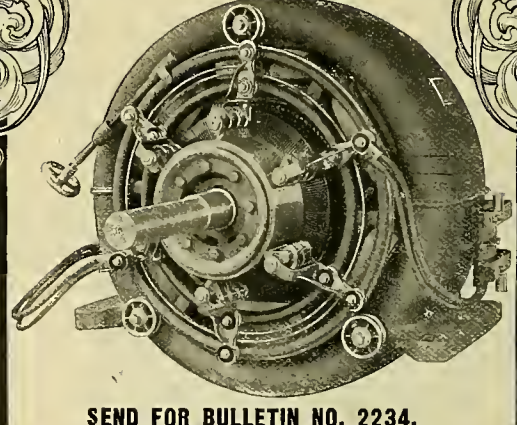

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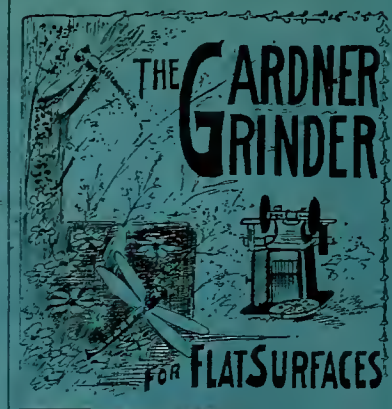

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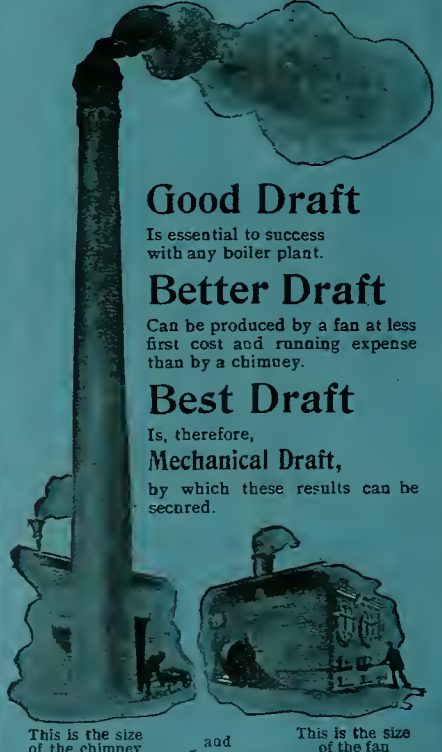

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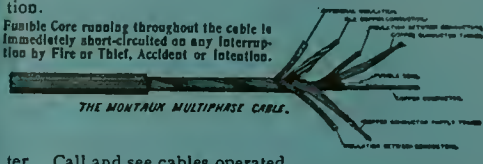

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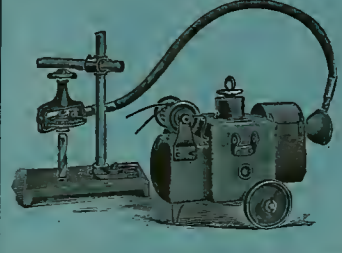

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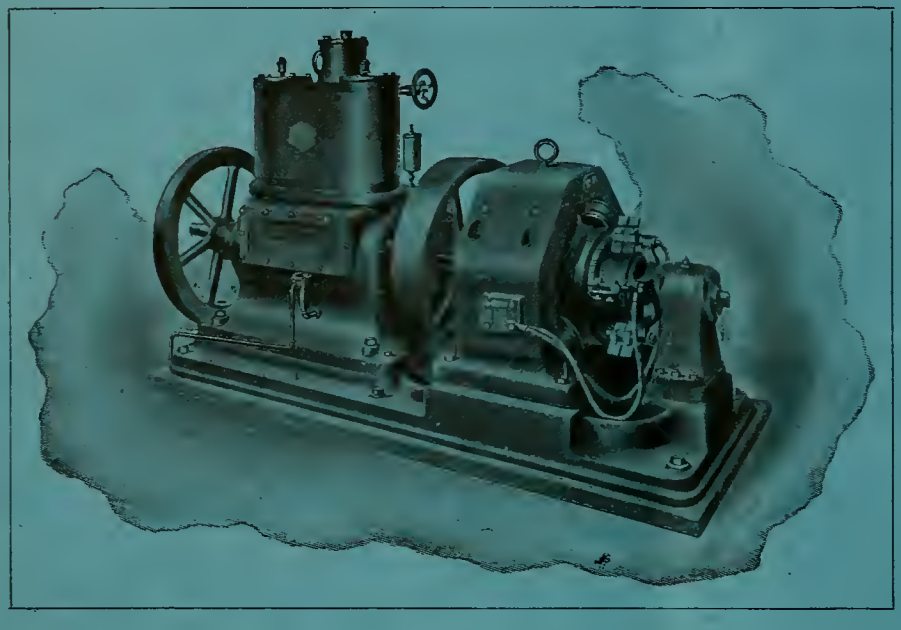

Exclusive Territorial Agents for

Eddy Direct Current Motors and Generators.

Can Make Prompt Delivery of All Sizes.
Write us for Bulletins, Etc.

ADAMS-BAGNALL ENCLOSED ARC LAMPS

For Direct and Alternating Current.

PERFECT IN REGULATION.
SIMPLE IN CONSTRUCTION.
EASY TO TRIM. LONG LIFE.

Prompt Shipments from St. Louis Stock.

Western Electrical Supply Co.,

Manufacturers, Jobbers and Dealers in
"Everything Electrical."

The Best Testimony is a Duplicate Order.

THE UNION TRACTION CO. OF PHILADELPHIA INSTALLED ITS FIRST BATTERY OF

CHLORIDE ACCUMULATORS

IN JULY, 1896, AND HAS RECENTLY CONTRACTED FOR FOUR ADDITIONAL BATTERY PLANTS.

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SALES OFFICES:

New York, 100 Broadway. Boston, 60 State St. Baltimore, Equitable Building. Cleveland, New England Building. Chicago, Marquette Building. San Francisco, The Parrott Building

HARDY LAMPS Uniform in Candle Power. Uniform in Watts per candle. Prices right. Prompt shipments. LAMP COMPANY, - PITTSFIELD, MASS.

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LONDON. PARIS.

MONA COMMUTATOR COMPOUND,

The most efficient lubricator, is the only article that is guaranteed to stop sparking. It can be used on leaf, carbon or gauze wire brushes with the greatest safety. Puts a beautiful luster on the Commutator. Does away with the use of sandpaper or any other material that wears out or destroys its surface. It is the largest and most economical stick manufactured. It comes in two sizes. Small size, $3.00 per dozen. Large size, $5.00. Samples mailed free on application. For sale by all supply houses throughout the United States, England and Canada.

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Manufactured only by TROTTER'S MONA MFG. CO., Ltd., 320 Broadway, New York, N. Y.
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Enclosed Arc Lamp.

Direct and Alternating.

Permanent Alignment,
High Efficiency,
Accessibility.

Handsome Fall Catalogue, Showing new features and Designs now ready. It is worth sending for.

Lea Manufacturing Co.
ELWOOD, IND.

THE BULLOCK ELECTRIC MFG COMPANY

CINCINNATI OHIO

SEND FOR BULLETIN NO. 2234.

85 8-'99

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FOREIGN AND DOMESTIC

CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PERFECTION.

PERFECTION.

OPEN OR CLOSED CIRCUIT WORK.

Electric Generator In a 6x8 Glass Jar.

E. M. F.—2 Volts. CURRENT—12 Amperes. CAPACITY—300 Ampere-Hours.

Will do the work of any two batteries on the market, and can be renewed at the least cost.

For Signal Service, Long-Distance Telephones, Gas Engines, Etc.

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EDDY GENERATORS

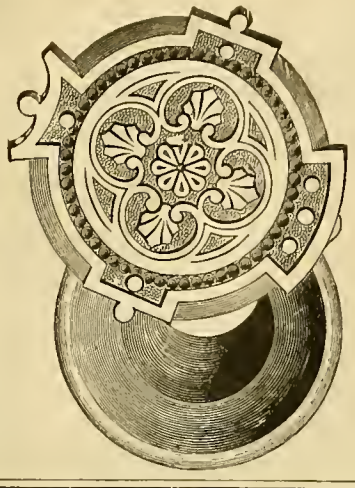
Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We make a specialty of apparatus for the transmission of Electrical Power through factory or other buildings.

The EDDY ELECTRIC MFG. CO., Windsor, Conn.

CHICAGO, 837-838 Marquette Building.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
ELMIRA, S. N. Blake.
SAN FRANCISCO, CAL., California Elec. Works, 409 Market St.
NEW YORK OFFICE, Singer Bldg., 149 Broadway.
BOSTON, G. M. Angier & Co., 64 Federal St.
ST. LOUIS, Western Electrical Supply Co.
CINCINNATI, Nevada Bldg. John A. Stewart.



YOU CALL YOUR NEEDS,
WE'LL DO THE REST.

WE HAVE

SPEAKING TUBE SUPPLIES

For house, hotel and factory use. Goods up-to-date, stocks ample, shipments prompt. Dealers and contractors write us for information.

Central Electric Company,

GEO. A. McKINLOCK, Pres. CHARLES E. BROWN, Secy.
264, 266, 268, 270 FIFTH AVENUE, CHICAGO.
SOUTHERN ELECTRICAL SUPPLY CO., ST. LOUIS.

OKONITE — IT NEVER DISAPPOINTS

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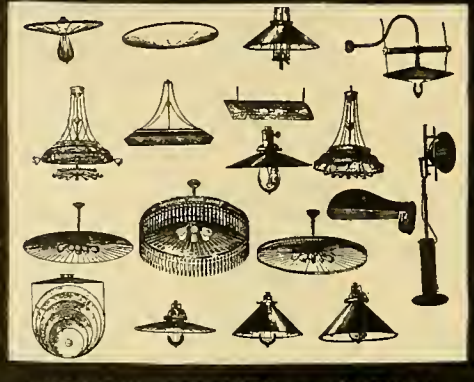

AMERICAN REFLECTOR & LIGHTING CO.
CHICAGO.

A new T.-H. Arc Lamp is hard to beat, and you CAN'T beat it if you fit it up with the **Knutson Gravity Clutch.**

YOUR OLD T.-H. ARC LAMPS

Will be good as new if you fix them up RIGHT, and BETTER if you take out old-style clutches and fit them up with the

Knutson Gravity Clutch,

The only clutch ever made that can be put in a lamp without taking rods out. We can FIX your T.-H. Lamps and make them better than they ever were.

Write Us for Prices and Particulars.

A. W. KNUTSON & CO., Galesburg, Ill.

Vitogen

For Electricians

Vitogen should be in every **power house,** for the simple reason that it is the best antiseptic dressing you can obtain for treating **burn wounds,** etc., with.

There is no guess work about it. Write for 52-page book, "Vitogen in Practice," telling how it saved one electrician's life. This is a necessity that you should not be without.

Sold by druggists or mailed on receipt of price; 2 oz., 50c.; 4 oz., $1.00. Canadian price: 2 oz., 60c, 4 oz., $1.20.

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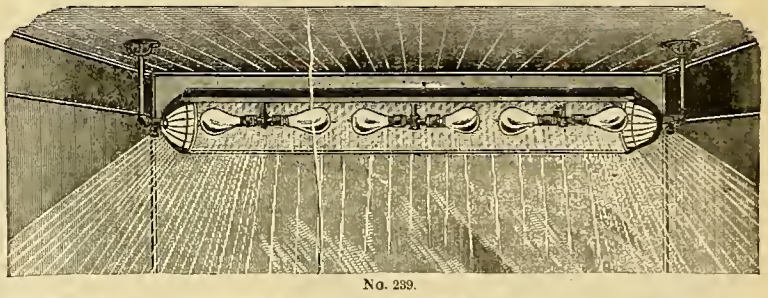
Canadian Branch, Mille Roches, Ont., KEZAR & BENNETT, Agents.

KLEMM & CO.,

N. W. Cor. 5th and Cherry Sts., Philadelphia.

Reflectors and Shades for Electric Light.



No. 239.

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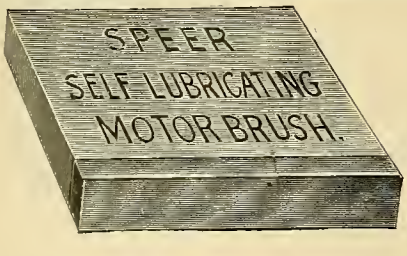
"KLEMM" PATENT ADJUSTABLE REFLECTOR, cheapest and best Reflector for lighting **Show Windows and Art Galleries.**

Send for Catalogue of Reflectors for Stores, Churches and general purposes.



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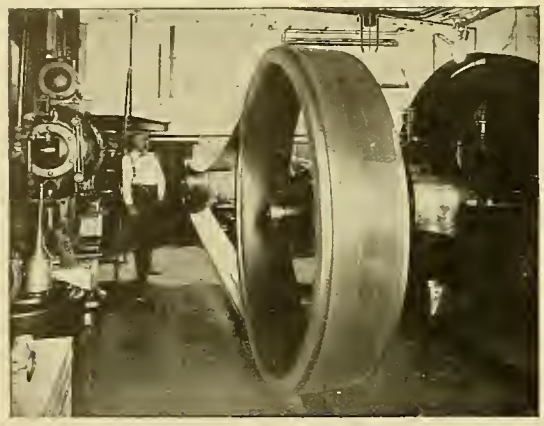
SPEER CARBON CO.,

Andrew Kaul, Pres. Louis Streuber, Vice-Pres.
Andrew Kaul, Jr., Secy. and Treas. J. S. Speer, Gen'l Mgr.

ST. MARYS, PA.



Four Months Ago

This belt was as tight as a fiddle string, under about 1,000 lbs. initial tension, and yet was slipping. There is no slip now, for it runs slack. **CLING-SURFACE** did it.

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Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

CLING-SURFACE MFG. CO.,

177-182 Virginia Street,

CHICAGO BRANCH, 225 DEARBORN ST. BUFFALO, N. Y.

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Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

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Queen & Co.
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Victor Electric Co.
Western Electric Co.
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Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

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Stow Mfg. Co.

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Rolfe Electric Co.

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Central Electric Co.
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Gov'nors, Water Wheel.
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Chicago Edison Co.
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Electric Appliance Co.
Emerson El. Mfg. Co.
General Inc. Arc Light Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
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National India Rubber Co.
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Paiste Co., H. T.
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General Electric Co.
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Johnston, Thomas J.
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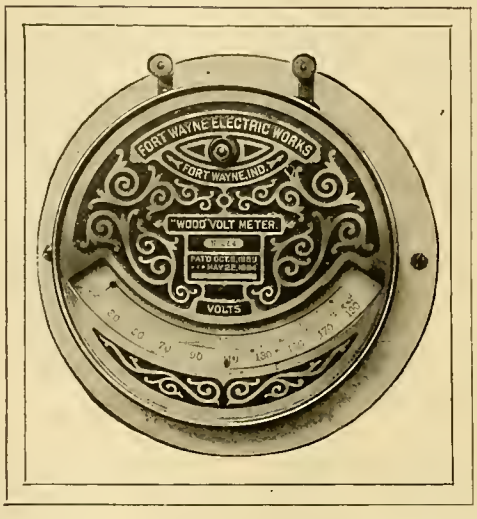

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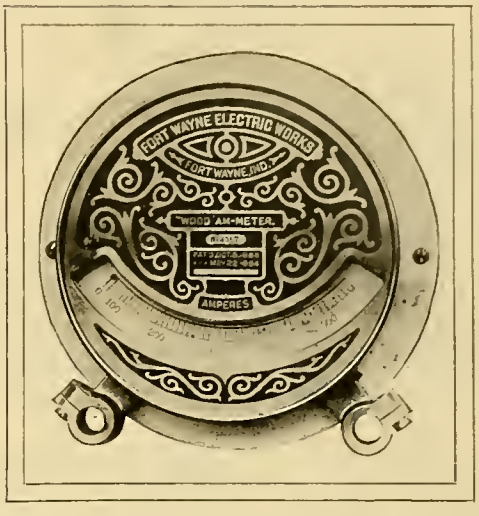

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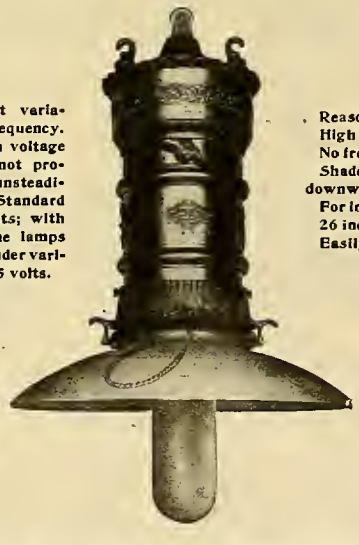

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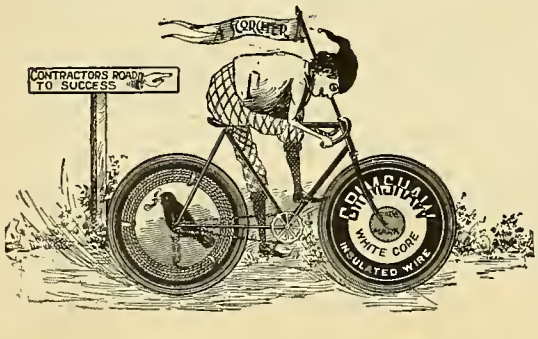

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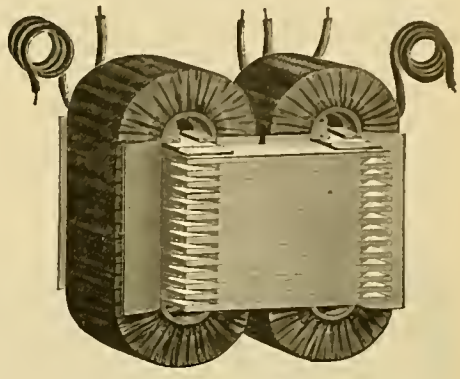

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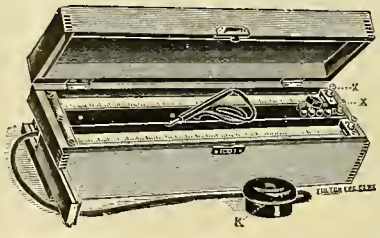

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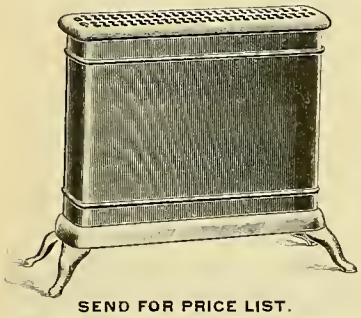

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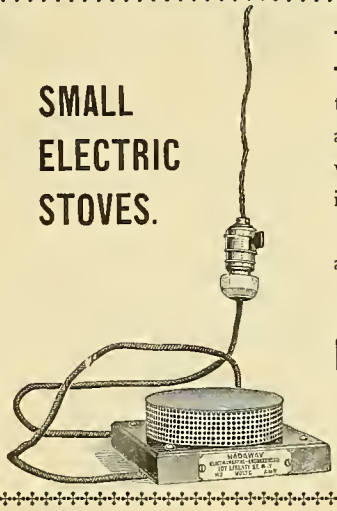

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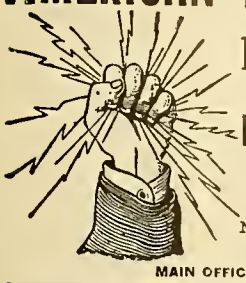

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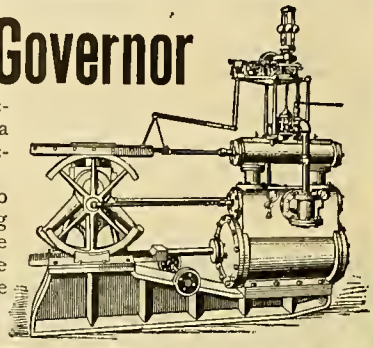

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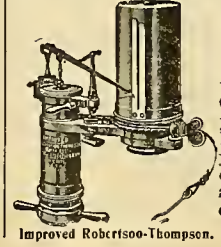
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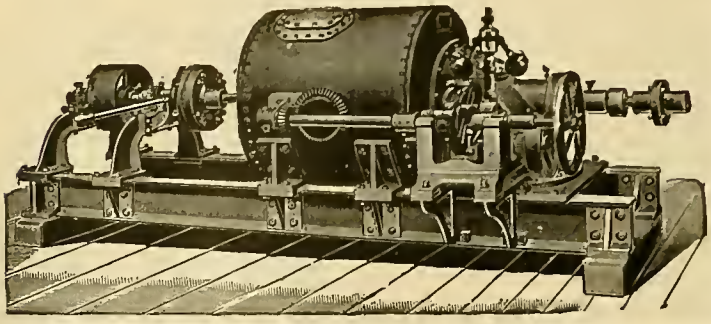

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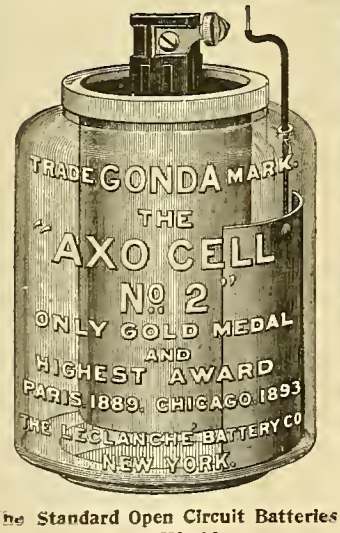

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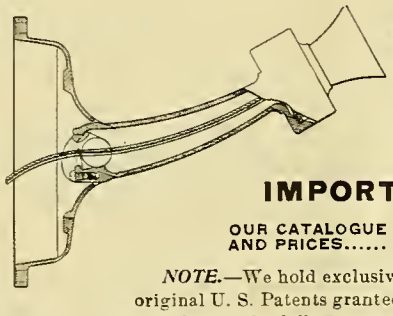

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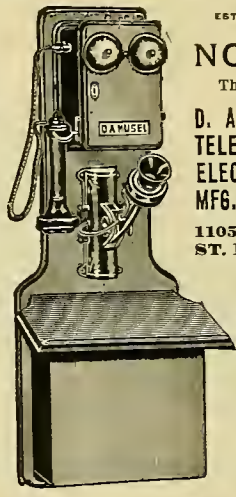

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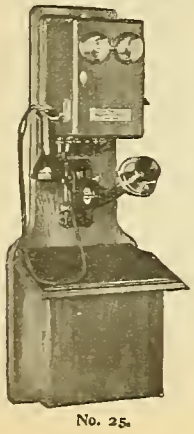
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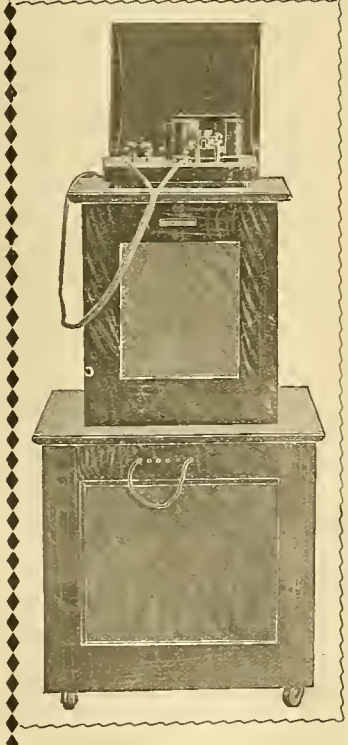

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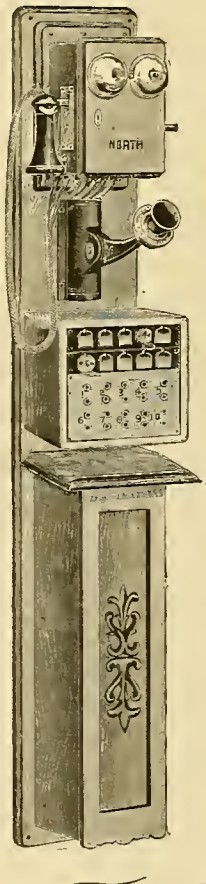

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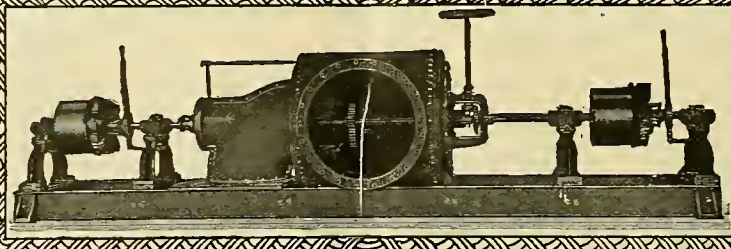

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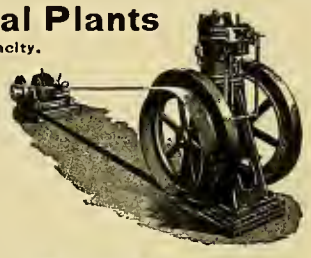

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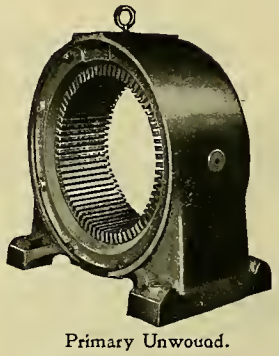

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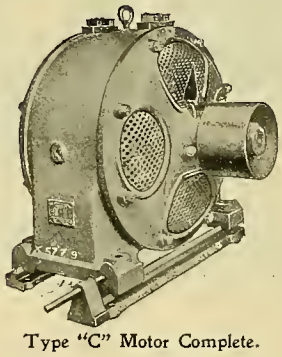

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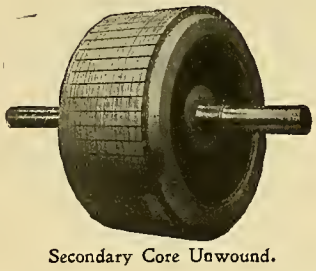

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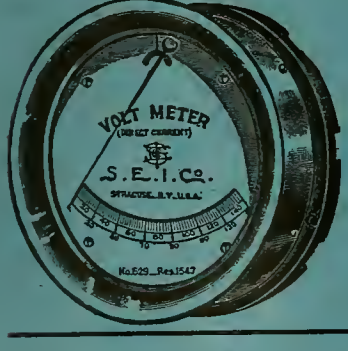

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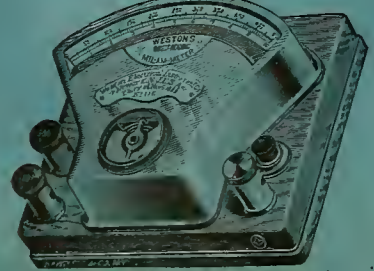

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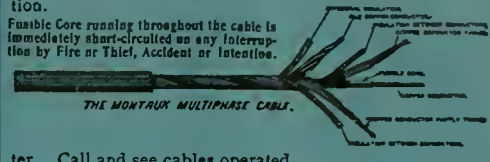

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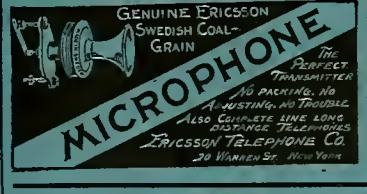

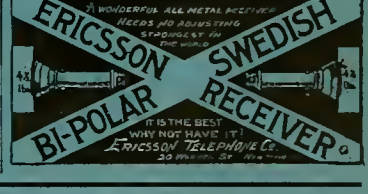

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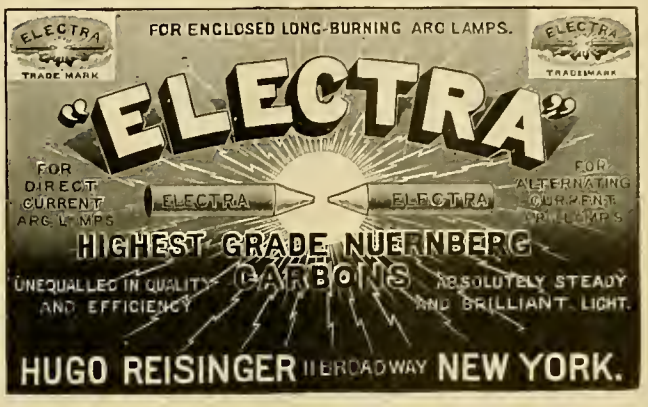

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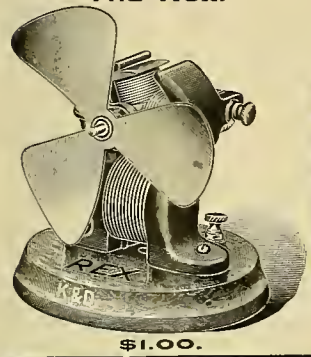

Run on One Cell Battery.
$1.00.

Made for durability and superior in every way to any manufactured for the price.

Send for catalogue.

KENDRICK & DAVIS,
LEBANON, N. H.

The Ajax.

Run on One Cell Battery.
$1.50.

CHICAGO INSULATED WIRE CO.
152-154 Lake St.
CHICAGO, ILL. U.S.A.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

DOES

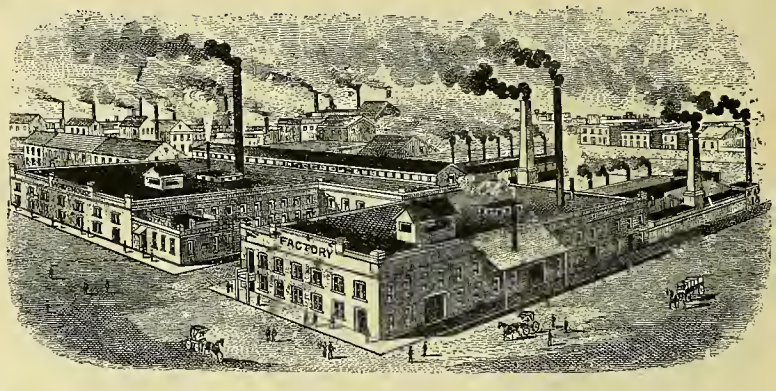
Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

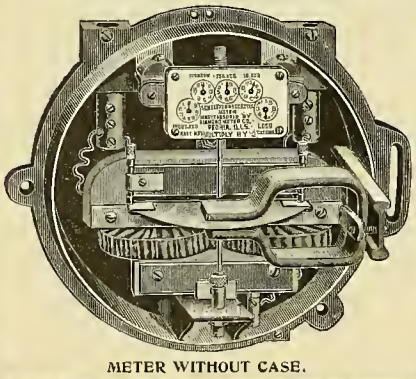
We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

SCHEEFFER RECORDING WATT-METERS.



METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,

PEORIA, ILL., U. S. A.

METER WITH CASE.

"HE GEM" STRAIGHT LINE HANGER

Has distinct deserving features. The Beaded Skirt forces rain and moisture to drip instead of run off—making a net current saving. The solid-piece Cap and Yoke eliminates the wear of part on part. The Automatic Locking Device reduces parts and cost. The fact of manufacture by the CENTRAL UNION BRASS CO. is a guaranty of good material and workmanship.

Central Electric Company,

264-270 Fifth Avenue, CHICAGO.

ELECTRIC RAILWAY SUPPLIES.

PARAGON REFLECTORS

Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

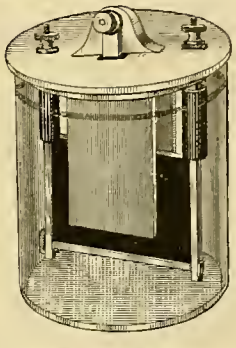
Thousands of this style used in show windows. Get our Catalogue and Prices.

American Reflector & Lighting Co.,

271-273 FRANKLIN ST., CHICAGO.

EDISON LALANDE BATTERIES.

FOR GAS ENGINES, SLOT MACHINES, AUTOMOBILES, RAILROAD SIGNALS, CROSSING BELLS, SMALL MOTORS, ETC.



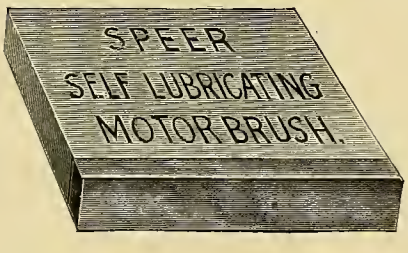
CONSTANT CURRENT. NO LOCAL ACTION, WILL NOT FREEZE. LIQUID TIGHT CELLS FOR PORTABLE WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

EDISON MANUFACTURING COMPANY,

THOMAS A. EDISON, PROPRIETOR. 135 FIFTH AVENUE, NEW YORK.

CARBON MOTOR BRUSHES



ANNOUNCEMENT:

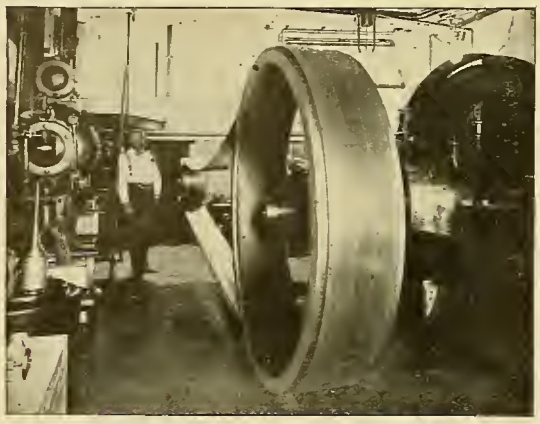
The Speer Carbon Co., organized with Capital $200,000, has just completed a large, expensive and modern factory at St. Marys, Pa., and now solicits your orders.

These Brushes are made under the direct personal supervision of Mr. J. S. Speer, who was for nine years a manufacturer of carbon brushes at Sandusky, O., which is the Company's guarantee of the first-class nature of its products.

SPEER CARBON CO.,

Andrew Kaul, Pres. Louis Streuber, Vice-Pres.
Andrew Kaul, Jr., Secy. and Treas. J. S. Speer, Gen'l Mgr.

OFFICE AND FACTORY: **ST. MARYS, PA.**



BROWN, DURRELL & CO.

Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say.
Write Us.

CLING-SURFACE MFG. CO.,

177-182 VIRGINIA ST., BUFFALO, N. Y.

CHICAGO BRANCH: 225 Dearborn St.

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Shultz Belting Co.

Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

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Western Elect. Supply Co.

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Cables (See Insulated Wires.)

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McLennan & Co., K.
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Westinghouse El. & Mfg. Co.

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Badaway El. Htg. & Eng. Co.

Electric Railways.
Arnold El. Power Station Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electric Vehicles.
American El. Vehicle Co.
Woods Motor Vehicle Co.

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Arnold E., Power Station Co.
Bain, Foree.
Bryan & Humphrey.
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Hodge-Walsh Elec. Eng. Co.
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Queen & Co.
Rolfe Electric Co.
S. E. I. Co.
Siemens & Halske Electric Co. of America.
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Western Electric Co.
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Westinghouse El. & Mfg. Co.
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General Inc. Arc Light Co.
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Ohio Electric Works.
Pringle, Wm. T.
Therien Tool Works.
Victor Electric Co.
Western Elect. Supply Co.

Electro-Plating Mach'y.
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General Electric Co.

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Cornell Machine Co.

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Vulcanized Fibre Co.

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Central Electric Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
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Bossert Elec. Const. Co.
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Buckeye Electric Co.
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Chicago Edison Co.
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Edison Decorative & Miniature Lamp Dept.
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Fort Wayne Lamp Co.
General Electric Co.
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Hardy Lamp Co.
Lynn Inc. Lamp Co.
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Sawyer-Man Elec. Co.
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(See Insulated Wires.)

Manipulators (Inc. Lmp).
Inc. El. Lt. Manipulator Co.

Mechanical Machinery.
Besly & Co., Chas. B.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle.

Meters.
Diamond Meter Co.
Wright Discount Meter Co.

Mica.
Central Electric Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Bullock Elec. Mfg. Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Motors.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago Rheostat Co.
Eagle Electric Works.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Hobart Elec. Mfg. Co.
Kendrick & Davis.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Siemens & Halske Electric Co. of America.
Sturtevant Co., B. F.
Thompson, Son & Co.
Towle, Geo. C., Mfg. Co.
United Elec. Imp. Co.
Victor Electric Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Packing.
Besly & Co. Chas. B.
Robertson & Sons, Jas. L.

Paints.
Central Electric Co.
Cling-Surface Mfg. Co.
Mass. Chemical Co.
Standard Paint Co.

Patent Attorneys.
Bamlin, Geo. R.
Johnston, Thomas J.
Roxton, Robert.

Phosphor Bronze.
Besly & Co., Chas. B.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.
Goldsmith Bros.

Poles.
Berthold & Jennings.
Central Mfg. Co.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Pendleton & Gilkey.
Perrizo & Sons.
Shelby Steel Tube Co.
Sterling & Son, W. C.
Texas Arm & Pin Co.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
Central Electric Co.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.
Klemm & Co.

Re-Winding—Repairs.
Chicago Edison Co.
Hodge-Walsh Elec. Eng. Co.
Stewart Electrical Co.

Rheostats.
Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Iron Clad Resistance Co.
Victor Electric Co.
Westinghouse El. & Mfg. Co.

Second-Hand Machin'y.
Chicago House Wrecking Co.
Hodge-Walsh Elec. Eng. Co.
Matthews, W. N.
Stewart Electrical Co.
Thompson, Son & Co.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.
Faries Manufacturing Co.
Klemm & Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Western Electric Co.
Western Elect. Supply Co.

Speed Indicators.
Besly & Co., Chas. B.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
Barnes Co., The Wallace
Cary Spring Works.

Steel Boxes.
Bossert Elec. Const. Co.

Stereopticons, Magic Lanterns and Slides.
Riley Bros.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.

Tapes, Insulating.
American Electrical Works.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
Central Tel. & Elec. Co.
Columbia Elec. & Mfg. Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Holyoke & Bolyoke.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Murdock & Co., W. J.
Noblett, E. J.
North Electric Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tl. M. Co.
Transmitter Mfg. Co.
Warner Co, W. F., The.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Cons. Co.
Williams Electric Co.

Tools.
Klein & Son, Mathias.
Therien Tool Works.

Toys, Electrical.
Ohio Electric Works.

Transformers.
Bullock Electric Mfg. Co.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
Gates & Randolph.
General Electric Co.
Kuhlman Electric Co.
Thompson, Son & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co

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Polyglot Co., The.

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Stilwell-Bierce Smith-Valle
Taylor, John W.

Varnishes.
Sterling Varnish Co,

Vulcanized Fibre.
Vulcanized Fibre Co.

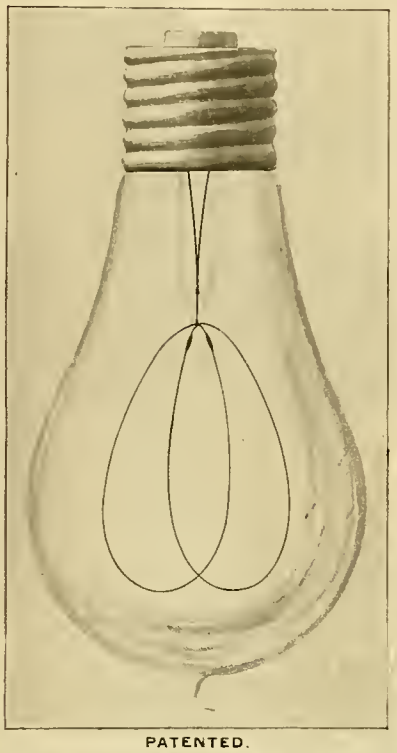
Wire, Bare.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Elect. Supply Co.

Woodwork, Electrical.
Noblett, E. J.

X Ray Outfits.
Central Electric Co.
Queen & Co.
Splitdorf, C. F.
Victor Electric Co.

For Alphabetical Index of Advertisements See Page III.

Made to burn in series on 500, 525 and 550 Volt Circuits.



PATENTED.

"NEW LYNN" STREET CAR LAMP.

This lamp has proven itself especially adapted to street railway use and to general use where a very strong lamp is required.

The filament is anchored and can not droop or be broken by motion of the car.

This lamp is carefully selected for current and all are therefore uniform and long lived.

It has absolutely no weak points, as its popularity testifies.

If you say so we will send you a barrel of these lamps to try. If not satisfactory they may be returned at our expense.

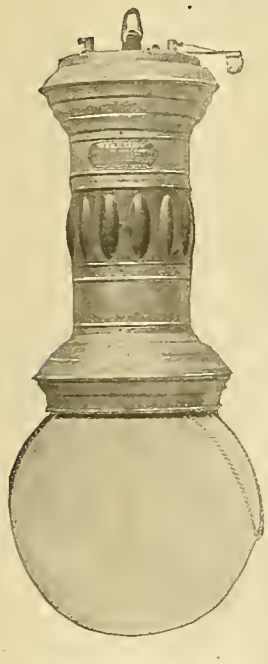
We can maintain your supply at a lower figure than is offered by any other first-class lamp manufacturer.

Write us for prices and full particulars.

LYNN INCANDESCENT LAMP CO.,

LYNN, MASS.

BY EVERY TEST THE BEST.



Constant Potential, 3 to 5 Amperes.

Constant Current Series, 5 to 7 Amperes.

Alternating Current, 3½ and 6 Amperes.

Series Alternating Current.

WRITE FOR NEW CATALOGUE.

A few good territories open for live agents.

STERLING ARC LAMP CO.,

214-222 West 26th St., NEW YORK.

Western Office: GATES & RANDOLPH, 13 Monadnock Block, Chicago, Ill.

Petite Alternating Enclosed Long-Burning Arc Lamp.

Adapted for great variations in voltage and frequency. Ordinary changes in voltage and frequency do not produce flickering or unsteadiness of the arc. Standard adjustment 104 volts; with this adjustment the lamps will burn steadily under variations from 90 to 115 volts.

Reasonable cost.
High efficiency.
No framework in sight.
Shade reflects upward rays downward.
For indoor and outdoor use.
26 inches long.
Easily trimmed.

PETITE ALTERNATING ENCLOSED ARC LAMP, STANDARD M SHADE AND EGG GLOBE.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

MANUFACTURERS AND DEALERS,

Electric Light and Power Apparatus,
Arc and Incandescent Lamps, Wire, Cable,
Telegraph Station and Measuring Instruments,
Electric Light and General Supplies.

LONDON, 79 Coleman Street, E. C., and North Woolwich, E.

ANTWERP, 33 Rue Boudewyns.

PARIS, 46 Avenue de Breteuil.

AMERICAN STEEL & WIRE CO.

AND THE

WASHBURN & MOEN DEPARTMENT,

CHICAGO. (GENERAL OFFICES.) NEW YORK. WORCESTER. SAN FRANCISCO.

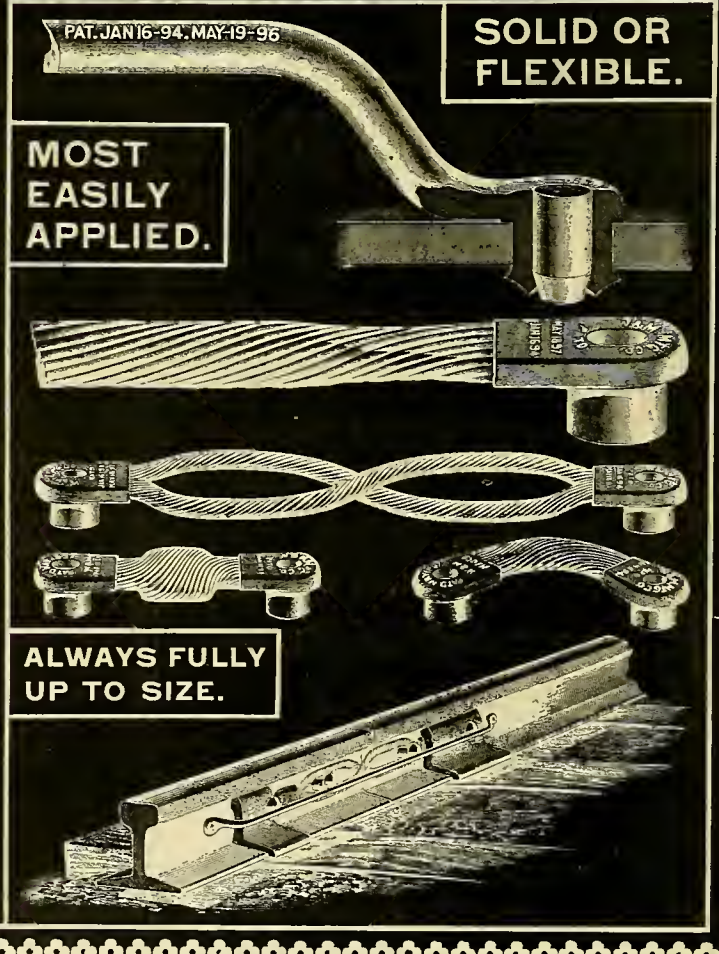
MANUFACTURERS OF THE WORLD RENOWNED

"CROWN" RAIL BONDS.

PERFECT AND ELECTRICALLY MECHANICALLY.

One man can apply two "Crown" Bonds in same time required to apply one Bond of any other make. The saving thus effected will in many cases equal the price of the Bonds.

The number of "Crown" Rail Bonds sold annually is undoubtedly greater than the combined sales of all other makes of Rail Bonds.

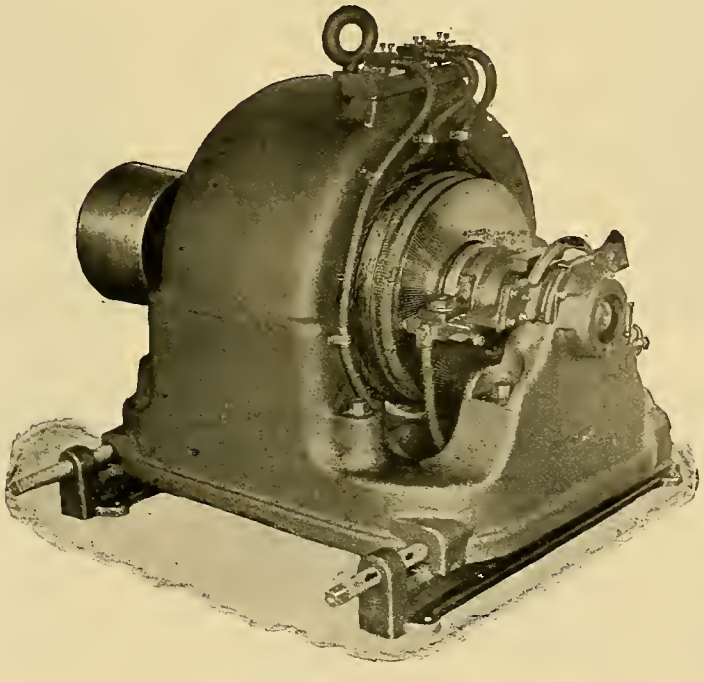


Transformers of all Kinds.

Wagner Products are High-Grade Products.

They are Efficient, Reliable, Simple and Guaranteed.

We are prepared to build any kind of static transformer for any voltage. Write us for prices and information.



Single-Phase A. C. Motor.

Our single-phase motors are going to all parts of the world. We are sending in one shipment 36 on the order of one company to a single South American city. We will be pleased to send descriptive circulars. These motors are self-starting with load and one-quarter (more if specified). Highly efficient. Noiseless in operation.

Wagner Electric Mfg. Co.,

BUILDERS OF

Street Railway Switchboards.
Switchboard Instruments.
Static Transformers.
Motor Driven Ventilating Fans.
Single-Phase Alternating Motors.
Direct-Current Motors and Dynamos.
Central Station Lighting Switchboards.
Other Electrical Specialties.

ST. LOUIS, MO., U. S. A.

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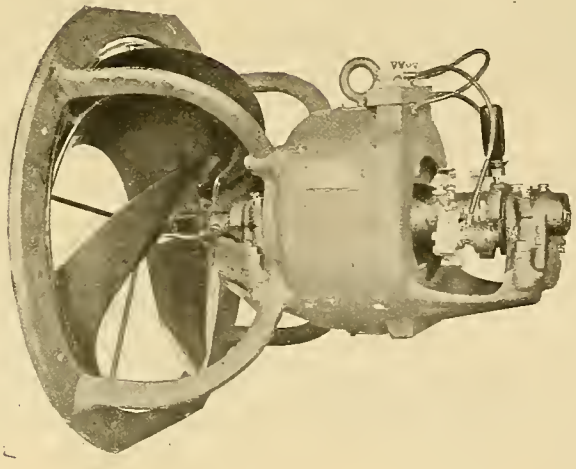
Boston, Philadelphia, San Francisco, New York, Chicago, Spokane.

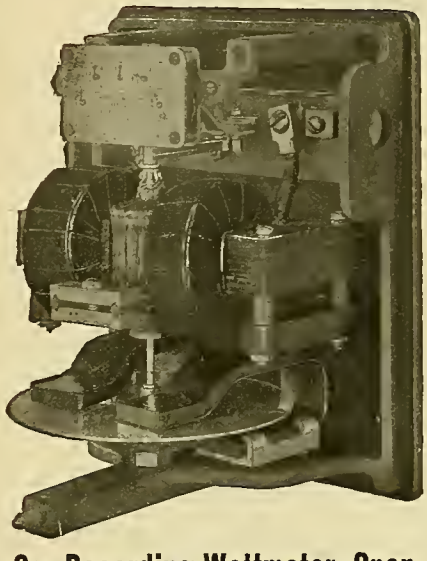
BAGNALL & HILLES, Yokohama, Japan. C. R. HEAP, 47 Victoria St., London.



Direct-Coupled D. C. Outfits.

THE GENERAL ELECTRIC COMPANY'S

STREET CAR METER



Car Recording Wattmeter, Open.

Is equivalent to a dynamometer record for every car which has it.

Car Recording Wattmeter, Closed.

This Street Car Meter enables the management of a street car company to distinguish between efficient and inefficient motormen. It shows the increased power cost of poor track. It picks out motors in need of repairs. It answers every purpose served by coal premiums in steam railway service. These statements can be fully proved by a trial of its utility.

GENERAL ELECTRIC COMPANY,

Main Office, Schenectady, N. Y.

SALES OFFICES:

Boston, Mass., 180 Summer Street.
New York, N. Y., 44 Broad Street.
Syracuse, N. Y., Sedgwick, Andrews & Kennedy Bldg.
Buffalo, N. Y., 901 D. S. Morgan Building.
Philadelphia, Pa., 509 Arch Street.
Baltimore, Md., 227 E. German Street.
Pittsburg, Pa., 502 Tradesmen's Bank Building.
Atlanta, Ga., Equitable Building.
New Orleans, La., 423 Baronne Street.
Cincinnati, Ohio, 426 W. Fourth Street.
Columbus, Ohio, 14 N. High Street.
Nashville, Tenn., 308 North Summer Street.
Chicago, Ill., Monadnock Building.
Detroit, Mich., 704 Chamber of Commerce Building.
St. Louis, Mo., Wainwright Building.
Dallas, Texas, Scollard Building.
Helena, Mont., Electric Building.
Minneapolis, Minn., Phoenix Building.
Denver, Colo., Kittredge Building.
San Francisco, Cal., Claus Spreckels Building.
Portland, Ore., Worcester Building.

For all business outside the United States and Canada: Foreign Dept., Schenectady, N. Y., and 44 Broad Street, New York.

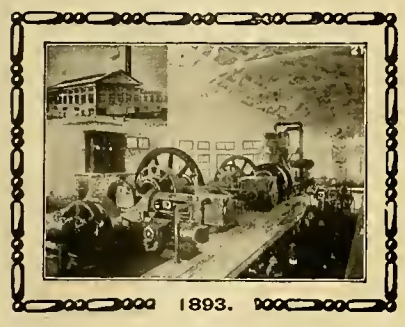
For Canada, address Canadian General Electric Company, Ltd., Toronto, Ontario.

WE DESIGN AND BUILD

Complete Electric Power Properties.

OUR RECORD.

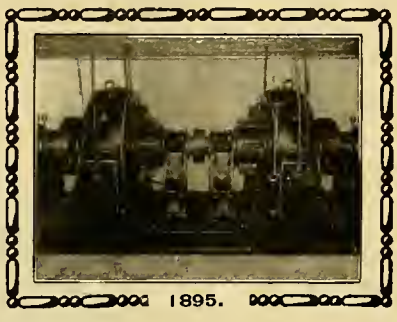
The plants of the following companies were built from the designs of the president of this company, while acting in the capacity of consulting engineer.



1893.

COLUMBIAN INTRAMURAL RAILWAY,
AT THE WORLD'S FAIR.

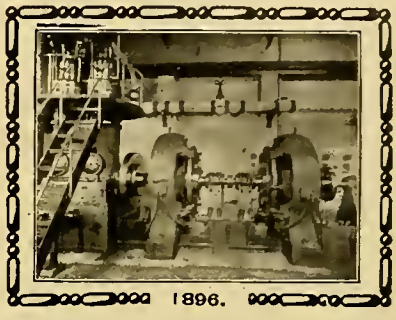
The FIRST successful elevated electric road in the United States.



1895.

CHICAGO BOARD OF TRADE.

The FIRST isolated plant to successfully operate arc lights, incandescent lamps, motors and electric elevators off one set of mains by means of a storage battery.

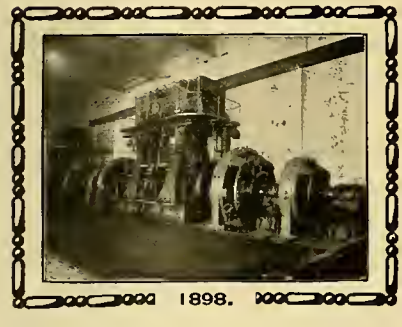


1896.

ENCLEWOOD & CHICAGO ELECTRIC RAILWAY.

The FIRST successful storage battery road in the United States.

THIS COMPANY DESIGNED AND BUILT

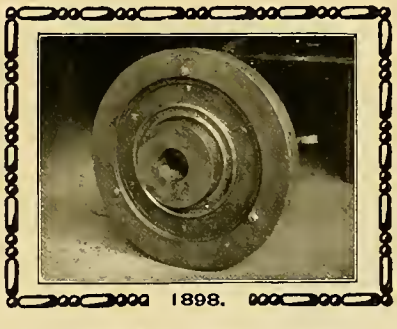


1898.

The power station of

THE IMPERIAL ELECTRIC LIGHT, HEAT & POWER CO.
OF ST. LOUIS.

The FIRST direct-current central station in the United States to successfully operate incandescent lamps, arc lamps and 250 and 500 volt motors off one set of mains.

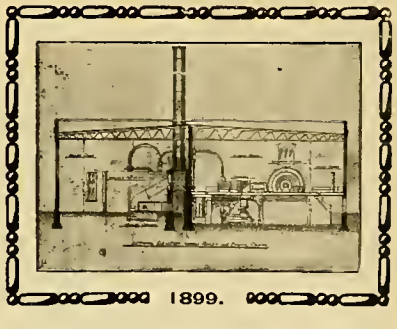


1898.

The complete light, heat and power plant of the

CHICAGO GREAT WESTERN RAILWAY CO.
AT OELWEIN, IA.

The FIRST plant to utilize magnetic clutches for connecting shafting.



1899.

The entire equipment excepting track of the

CHICAGO & MILWAUKEE ELECTRIC RAILWAY.

The FIRST long-distance electric railway operated from a central steam station, using three-phase transmission, rotary converters, sub-stations and battery auxiliaries.

In each of the plants built by this company a stipulated economy was guaranteed under a bonus and forfeiture contract.

This company is prepared to submit propositions on complete electric plants for any purpose under reliable guarantees, after learning particulars.

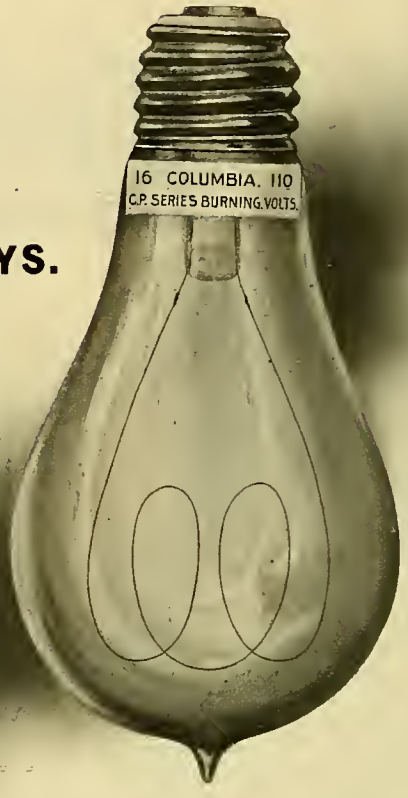
ARNOLD ELECTRIC POWER STATION COMPANY,

SUITE 1540 MARQUETTE BUILDING, ...CHICAGO.

ESTABLISHED 1889.

COLUMBIA LAMPS.

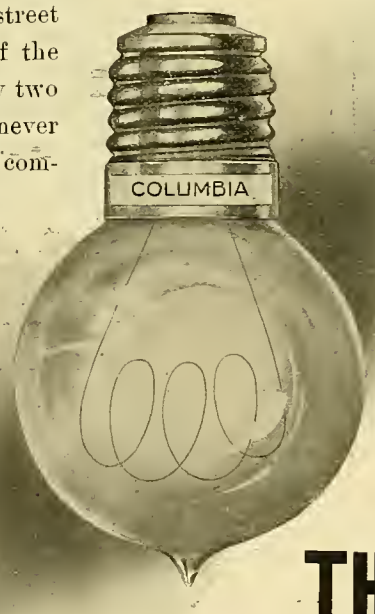
UNEQUALED IN QUALITY.



SPECIAL SERIES BURNING LAMPS FOR ELECTRIC STREET RAILWAYS.

The accompanying is a full size cut of the **Columbia Railway Lamp** for series burning on street railway circuits, and can be furnished as follows: 16 candle power only. Voltage, 90 to 125 for series of 5 on circuits of 450 to 600 volts. Efficiency, 4 watts per c. p. Plain glass, frosted or superficially colored. Genuine colored glass—ruby, blue, green amber and opal.

We guarantee our railway lamps absolutely uniform in current consumption, thereby giving a uniform distribution of light throughout the car. The filament is unanchored, having a 2½-turn coil, which gives it necessary stability and prevents any possibility of breakage from vibration. Our present type of railway lamp has been in use on some of the largest street railway systems of the country for nearly two years and we have never received a single complaint.



The accompanying cut is a full size reproduction of the COLUMBIA ROUND BULB OR WINDOW LAMP, which is used for show window and decorative lighting. It is also made for headlight purposes on electric street railway circuits and for decorative lighting in trolley party cars. For street railway service it is made in 16 c. p. only and in 4 watts efficiency, so that it can be operated in series with the other lamps in the cars. In ordering please specify "Headlight Lamps" if for use on street railway circuits.

Our regular lamps for commercial lighting are guaranteed uniformly high grade.

Trial order solicited.

THE COLUMBIA INCANDESCENT LAMP CO.

Main Office and Factory, 1910-12-14 OLIVE STREET, ST. LOUIS, MO.

NEW YORK OFFICE: 1311 Havemeyer Building.
CHICAGO: Central Electric Co.
SAN FRANCISCO: 120 Sutter Street.
MINNEAPOLIS, 295 Syndicate Arcade.

ALWAYS READY. NEVER DISAPPOINTS.

OUR OWN design and a sure winner with any current.

Stands up under most trying conditions.

Carries all kinds of tensions and can easily win in competition.

Has a peculiar resistance to water, all its own.

Equally as good in the air, underground or in the water.

It is certainly a good purchase. Ever tried it?

PROPRIETORS:

The Okonite Co., Limited,

253 BROADWAY, NEW YORK CITY.

Represented by CENTRAL ELECTRIC COMPANY, 264 to 270 Fifth Ave., Chicago.

THE "SHELBY THREE" TROLLEY POLE.

A Rigid Pole built up like a GUN from High Carbon SEAMLESS COLD DRAWN STEEL TUBING. Shows in Test Less Deflection than any Pole of 19 Pound Weight Ever Placed upon the Market.

ADOPTED BY THE LEADING ELECTRIC RAILROADS IN THE UNITED STATES AND CANADA. THE HIGH STANDARD OF QUALITY MEETING EVERY REQUIREMENT, (HIGH SPEED AND TENSION) MAKES THE "SHELBY THREE" A POPULAR TROLLEY POLE. A SAMPLE ORDER WILL CONVINCE YOU.

ALL STANDARD LENGTHS IN STOCK.

EACH POLE WARRANTED. EACH POLE TESTED AND CAREFULLY INSPECTED BEFORE SHIPPING. PRICES REASONABL'

SHELBY STEEL TUBE COMPANY GENERAL SALES OFFICE CLEVELAND, O.

144 CHAMBERS ST., NEW YORK. 135 LAKE ST., CHICAGO, ILL. 29 CONSTITUTION HILL BIRMINGHAM ENGLAND

—AGAIN—

THE TRIUMPH CO.

DEFEAT

WESTINGHOUSE CO.

"The United States Court of Appeals affirms the decision of the lower court in favor of the Triumph Electric Co. in suit of the Westinghouse Electric and Manufacturing Co. vs. the Triumph Electric Co."

NOTE: THAT WE PROTECT OUR GUARANTEES.

We Make Railway Generators, Either Belted or Direct Connected.

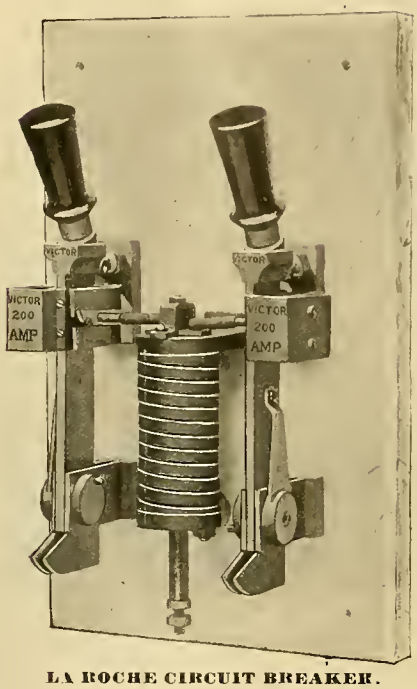
CHICAGO OFFICE, GATES & RANDOLPH, Monadnock Block.

THE TRIUMPH ELECTRIC CO.,
CINCINNATI, OHIO.

SEND FOR CATALOGUE AND BULLETINS.

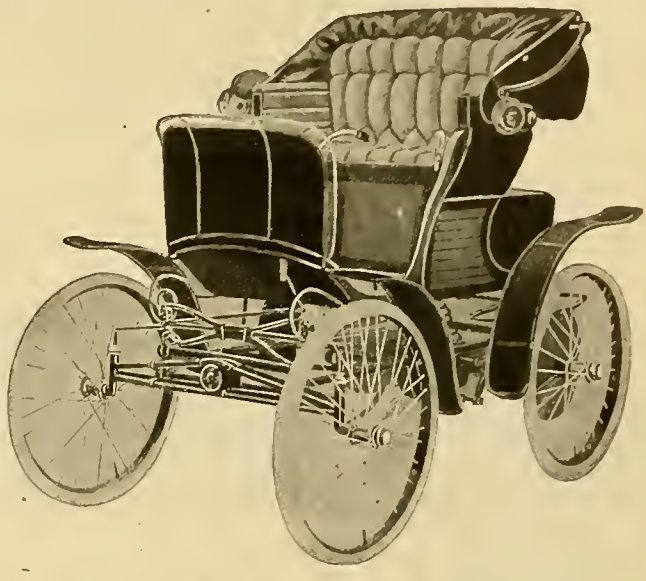
GATES & RANDOLPH,

13 MONADNOCK, CHICAGO.



LA ROCHE CIRCUIT BREAKER.

LaRoche "Ideal" and "Victor" Circuit Breakers Always the Best.



WAVERLEY STANHOPE.

WESTERN AGENTS:

Indiana Bicycle Co., Indianapolis, Ind., Automobiles,
Warren Alternators, Triumph Direct-Current Apparatus, Empire Electrical Instruments,
La Roche, Victor and Ideal Circuit Breakers, Diamond Meter Co.'s Meters and Transformers,
Sterling Enclosed Arc Lamps, Le Valley Vitae Lubricating Carbon Brushes.

The Best Education

Is that which helps to

Increase One's Salary

AMERICAN SCHOOL OF CORRESPONDENCE

Is conducted by technical experts of world-wide reputation and devoted exclusively to

Engineering { Steam / Electrical / Mechanical

AMERICAN SCHOOL OF CORRESPONDENCE — COMMONWEALTH OF MASSACHUSETTS — CHARTERED

Write To-day for "Hand-book R" and SPECIAL TERMS FOR OCTOBER ENROLLMENTS.

American School of Correspondence, Boston, Mass., U. S. A.

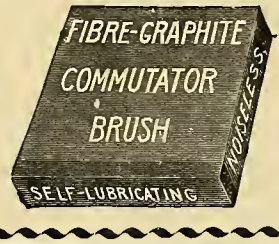
The Fibre-Graphite Commutator Brush.

(U. S. and Foreign Patents.)

No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.

For Sample Order, and Prices, write to

Holmes Fibre-Graphite Mfg. Co.,
5155 Wakefield St., Germantown, PHILADELPHIA.



LONDON.

PARIS.

MONA COMMUTATOR COMPOUND,

The most efficient lubricator, is the only article that is guaranteed to stop sparking. It can be used on leaf, carbon or gauze wire brushes with the greatest safety. Puts a beautiful luster on the Commutator. Does away with the use of sandpaper or any other material that wears out or destroys its surface. It is the largest and most economical stick manufactured. It comes in two sizes. Small size, $3.00 per dozen. Large size, $5.00. Samples mailed free on application. For sale by all supply houses throughout the United States, England and Canada.

TROTTER'S COMMUTATOR COMPOUND NEW YORK

Manufactured only by TROTTER'S MONA MFG. CO., Ltd., 320 Broadway, New York, N. Y.
Messrs. GOLDMARK & WALLACE are the Sole Agents for the United States, 121 Worth St., New York City.
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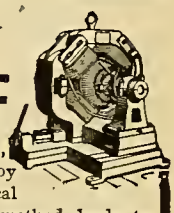

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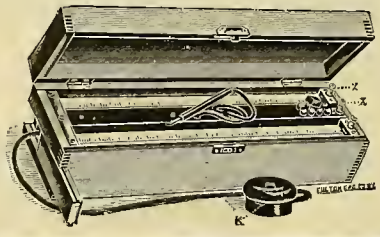

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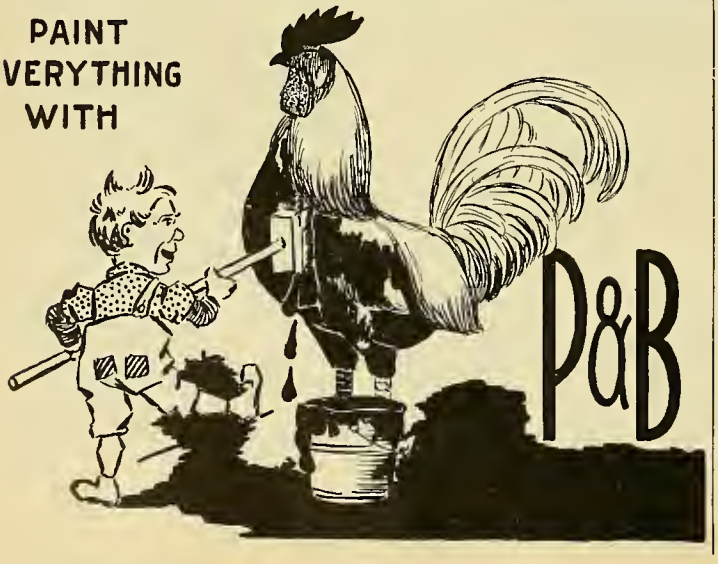

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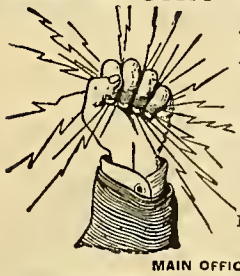

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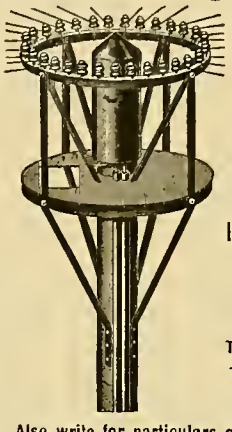

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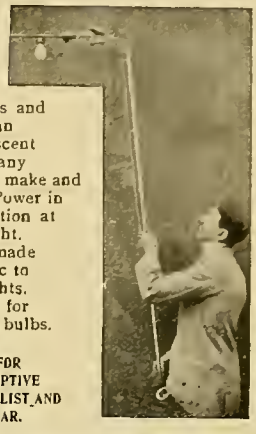

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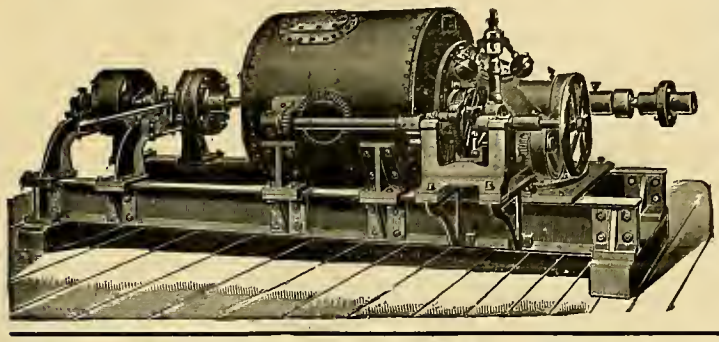

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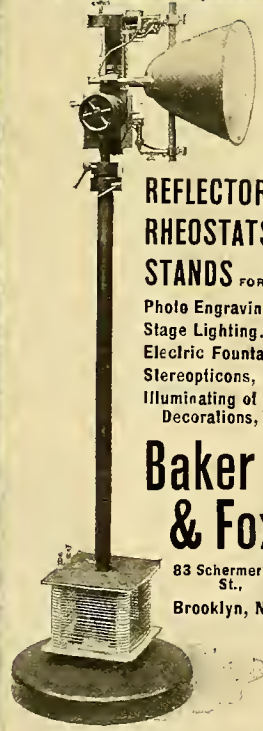

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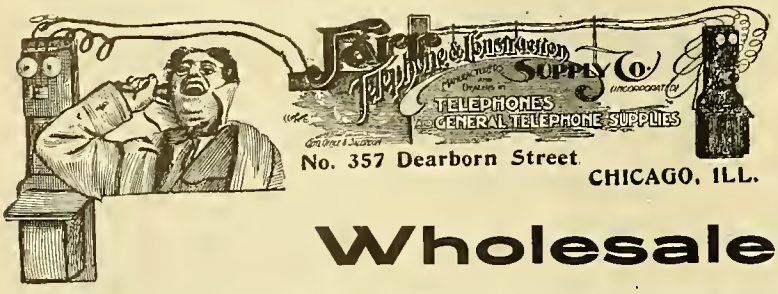

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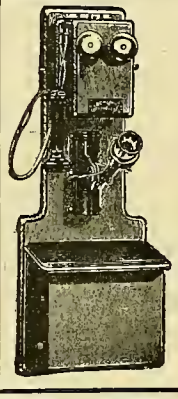

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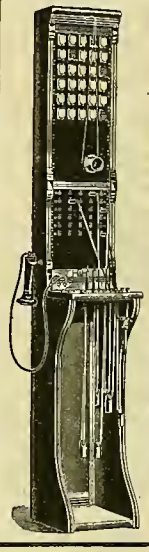
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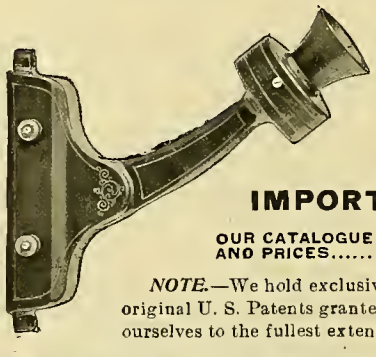
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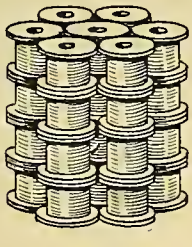

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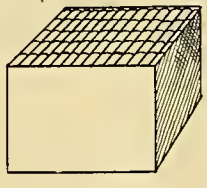

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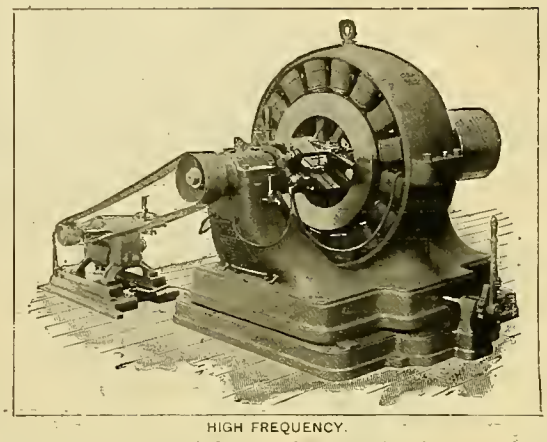

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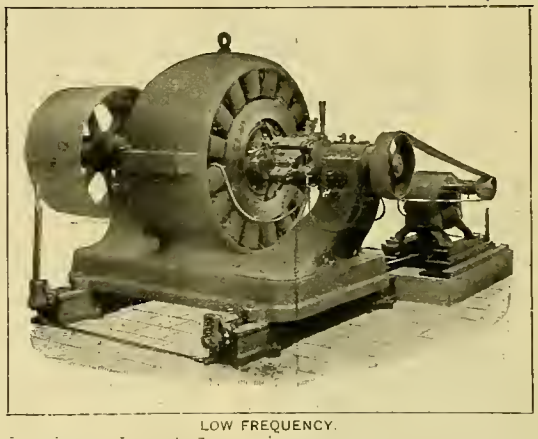

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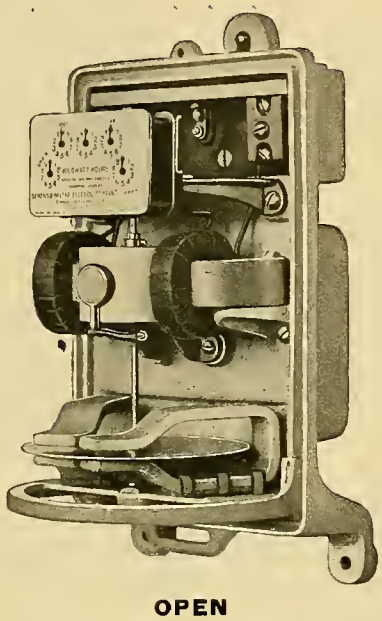

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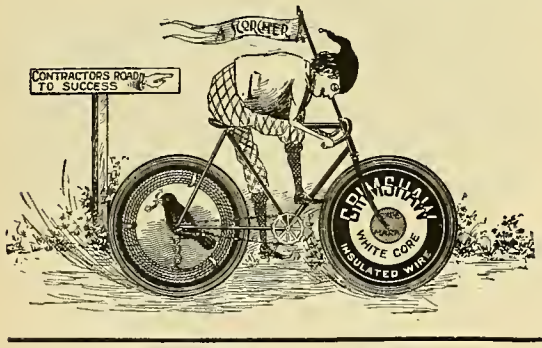

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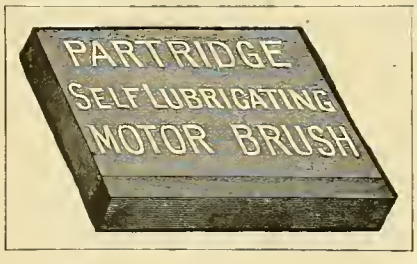

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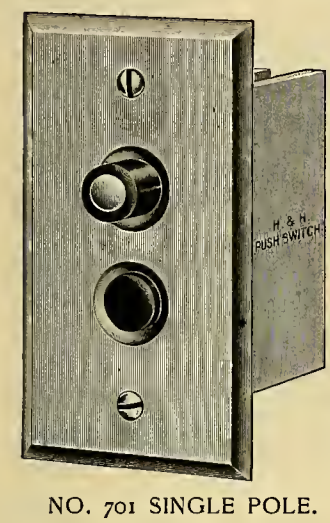

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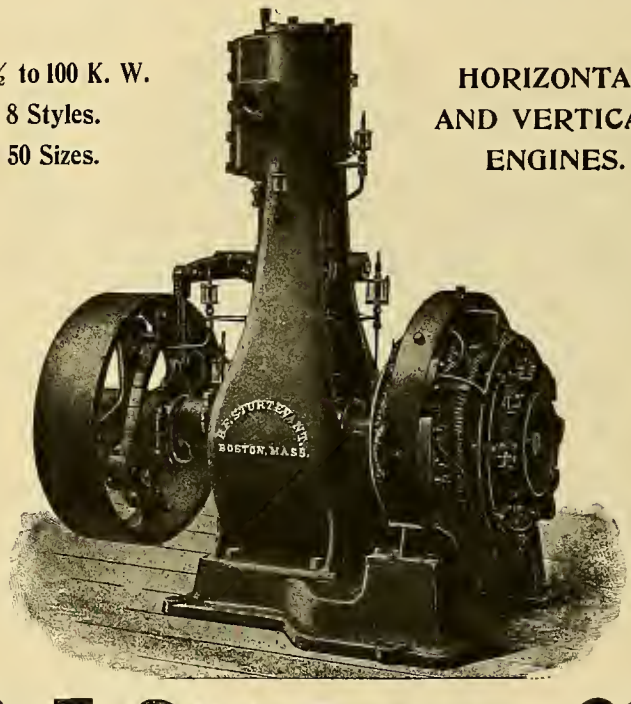

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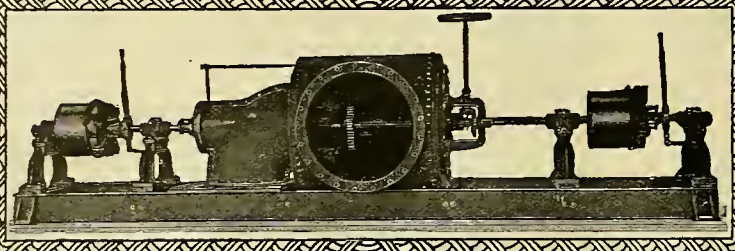

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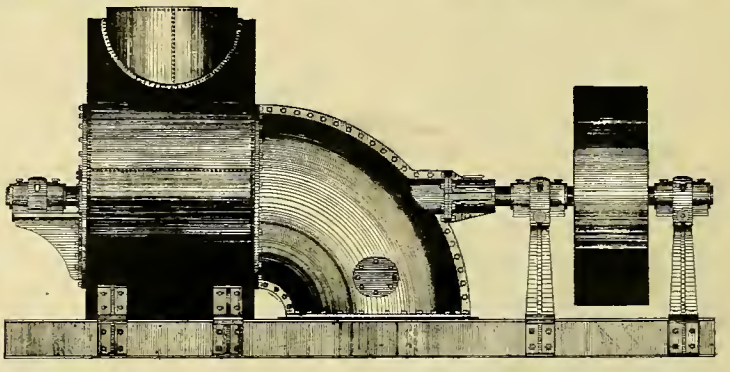

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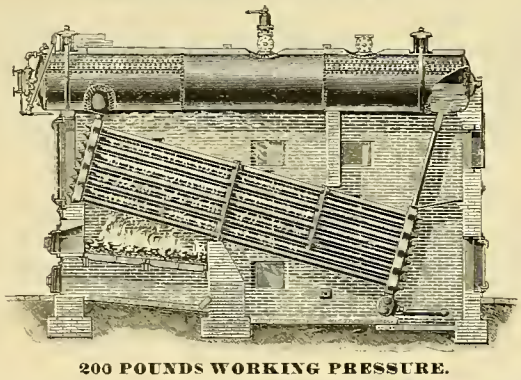

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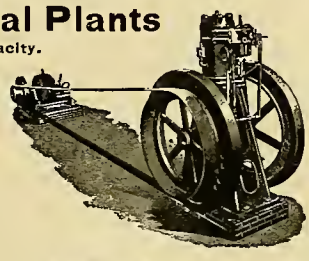

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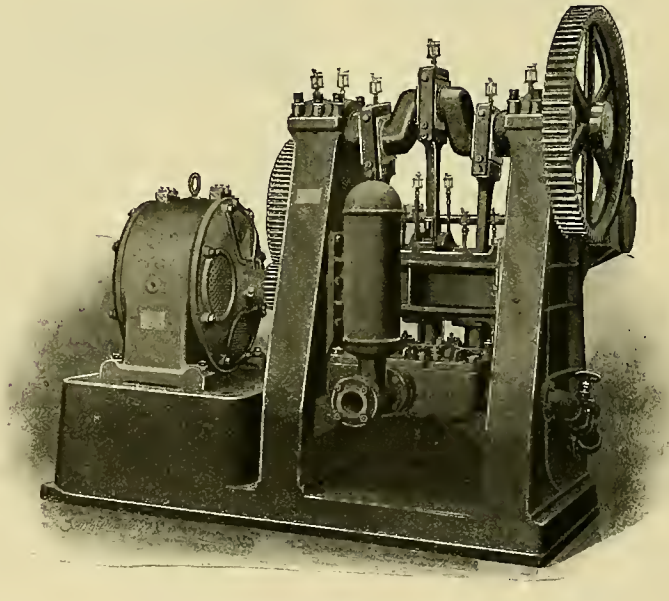

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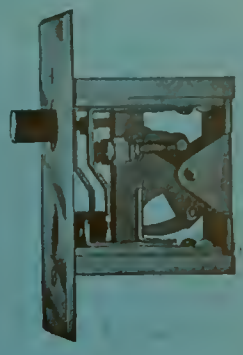

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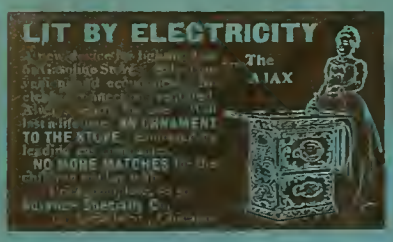

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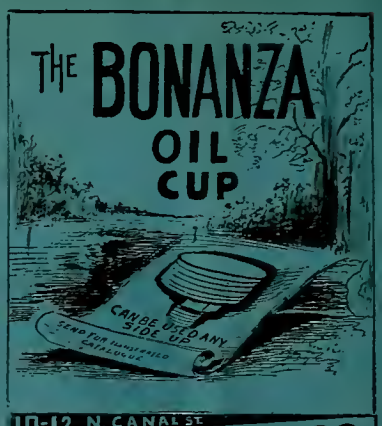

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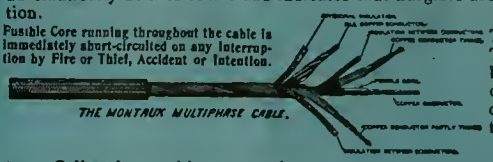

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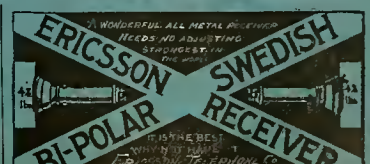

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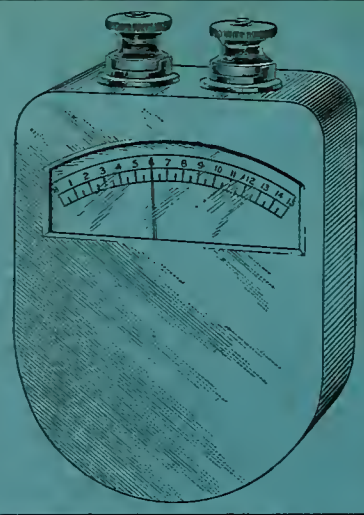

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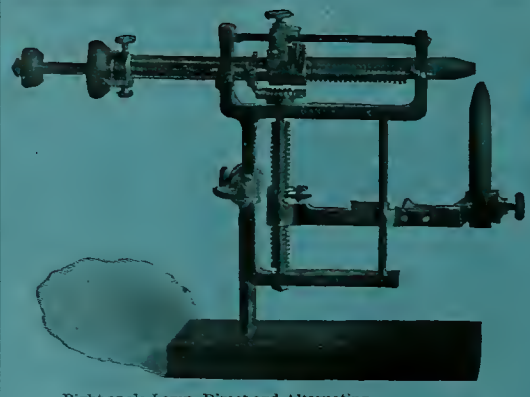

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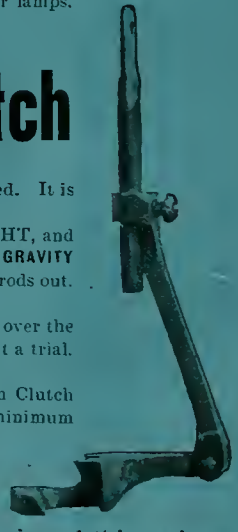

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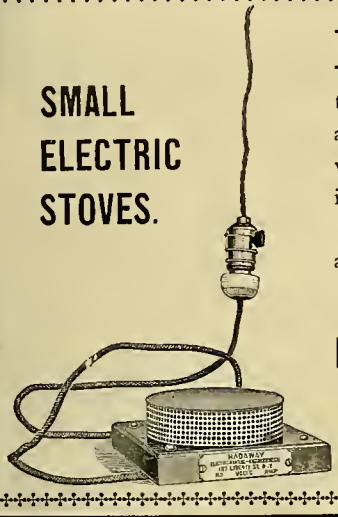

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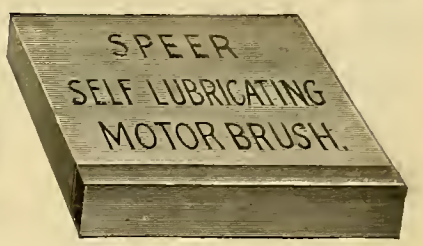

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FOREIGN AND DOMESTIC

CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

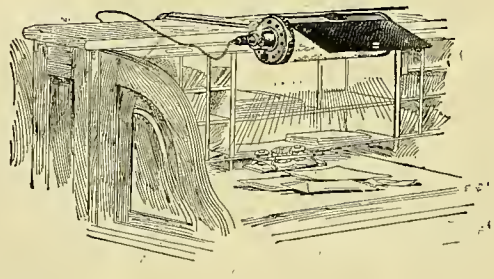
139 ADAMS STREET, CHICAGO.

SAVE YOUR EYES

BY USING THE

KINSMAN DESK LAMP.

Beware of Spurious Imitations.



Has many advantages over any desk light, shade or reflector in the market. Finished in nickel plate, polished brass or dark green enamel.

The eye shade, which serves as a reflector as well, may be moved by a touch to any desired angle, so that the desk alone may be illuminated, or an illumination may be obtained a short distance from the desk.

The inner glass cylinder has one clear glass surface and one of ground glass to soften the light, if desired. Turned by a knob at further side.

There is an adjustable arm, enabling the light to be drawn forward or pushed back at pleasure.

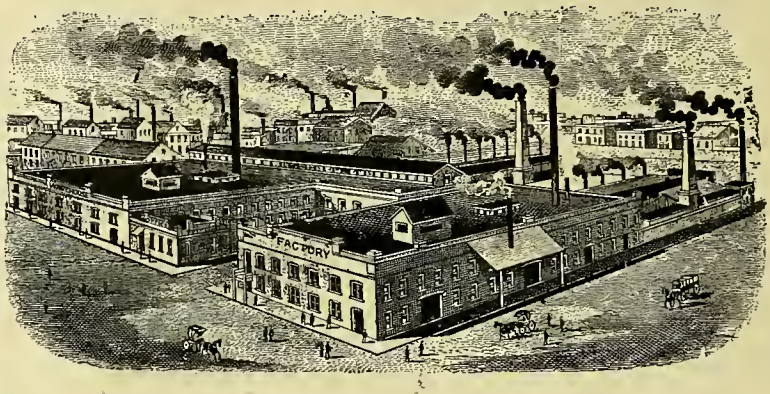
All these changes in use may be made readily, without rising from one's chair. The fixture may be clamped to the desk without marring it.

Send for Pocket Catalogue and Prices.

McLeod, Ward & Co.,

29 THAMES ST., NEW YORK.

PHOENIX.



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

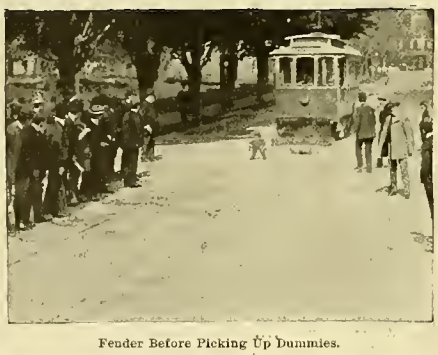
Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

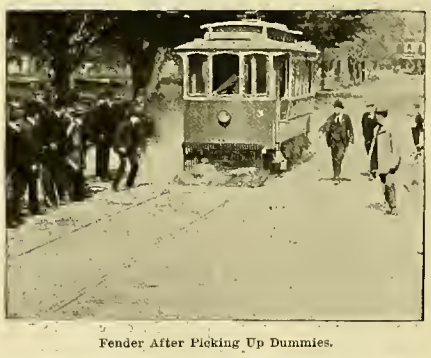
Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

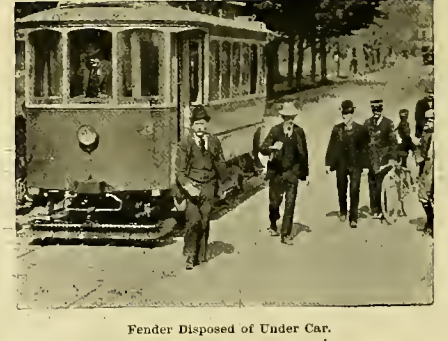
ST. LOUIS, MO.



Fender Before Picking Up Dummies.



Fender After Picking Up Dummies.



Fender Disposed of Under Car.

THE HIPWOOD-BARRETT CAR AND VEHICLE FENDER CO.,

EURDPEAN AGENT, FERDINAND RDMÜNDER, COLOGNE, GERMANY.

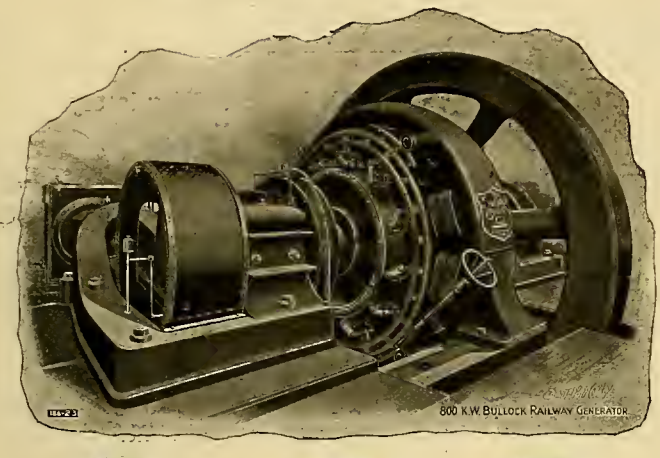
66 BROADWAY, NEW YORK.

MARQUETTE BUILDING, CHICAGO, ILLINOIS.

Central Electric Company,

GEO. A. McKINLOCK, Prest.
CHARLES E. BROWN, Secy.

264-270 FIFTH AVENUE, CHICAGO.



Western Sales Agents for
BULLOCK ELECTRIC MFG. CO.,
THE OKONITE COMPANY, LTD.
General Sales Agents for
CENTRAL UNION BRASS CO.

Convention Reports

Show value of attention to details and use of improved methods.

The details of

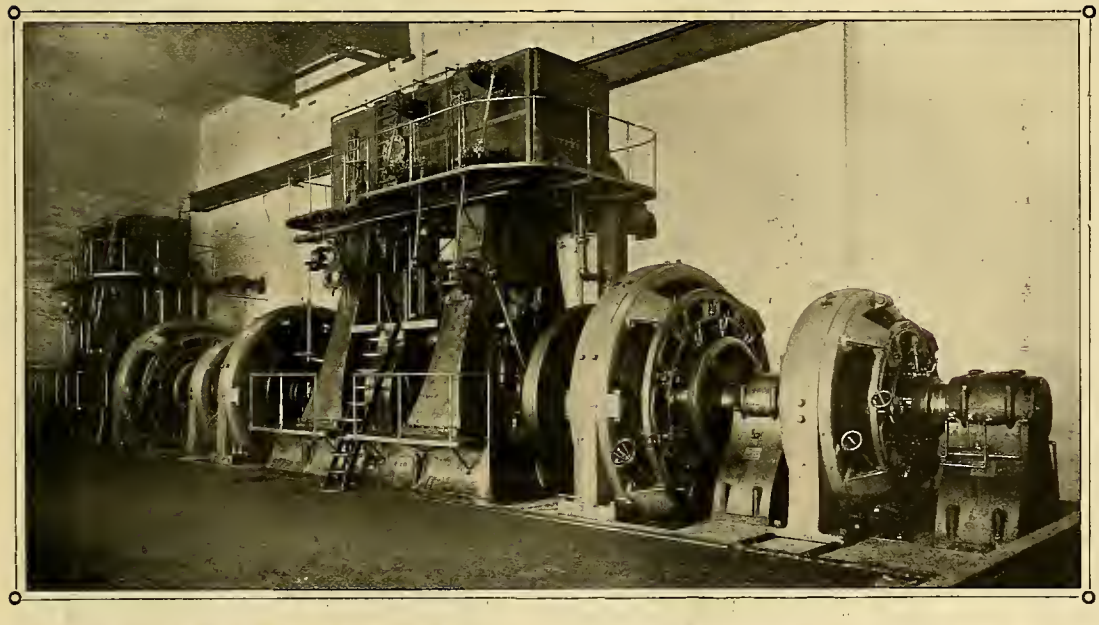
Bullock Engine Type Generators

Are worked out under most modern practice, with a large co-efficient for range of work and overload. Slow speed, while increasing first cost, gives length of operative life. Ventilation of fields and armature is given broadest regard, while insulation is not considered effective until dryness is assured by baking coils under pressure.

This machinery has features worthy of investigation. Send for Bulletin No. 34.

Electric Railway Supplies.

WE DESIGN AND BUILD COMPLETE PLANTS.

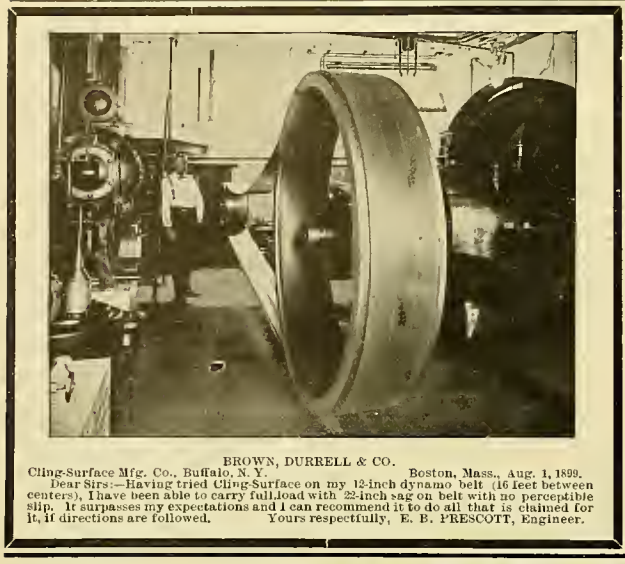


THE accompanying cut shows an interior view of the plant of the Imperial Electric Light, Heat & Power Co., St. Louis, Mo. Present capacity, 2,000 K. W. Built complete by the Arnold Electric Power Station Co., after designs furnished with its proposition. The First Central Station to adopt the Arnold Magnetic Clutch.

IF YOU HAVE A POWER PLANT or a complete electric railway or lighting plant to build we are prepared to submit to you or to your consulting engineer a proposition upon the entire job. We will guarantee the operation of the complete plant, both in regard to operation and also economy. We can save you time, annoyance and money. Suppose you write to us about it.

Arnold Electric Power Station Co.,

SUITE 1540 MARQUETTE BUILDING, ... CHICAGO.



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Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT

MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say.
Write Us.

CLING-SURFACE MFG. CO.,

177-182 VIRGINIA ST., BUFFALO, N. Y.

CHICAGO BRANCH: 225 Dearborn St.

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Shultz Belting Co.

Belting.
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General Electric Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
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Queen & Co.
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Rolfe Electric Co.
S. E. I. Co.
Siemens & Halske Electric Co. of America.
Victor Electric Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

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Westinghouse El. & Mfg. Co.

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Globes and Electrical Glassware.
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Holmes Fibre-Graphite Co.

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Psiste Co., H. T.
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Mica.
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Chicago Rheostat Co.
Eagle Electric Works.
Eddy Elec. Mfg. Co.
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Thompson, Son & Co.
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Mass. Chemical Co.
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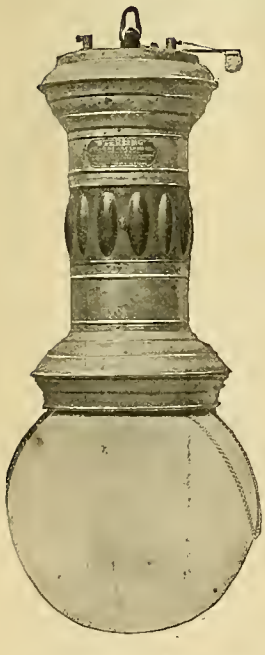

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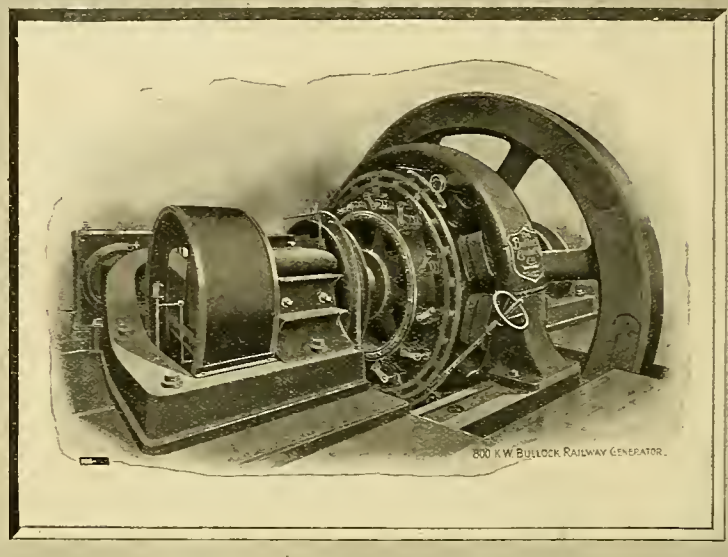
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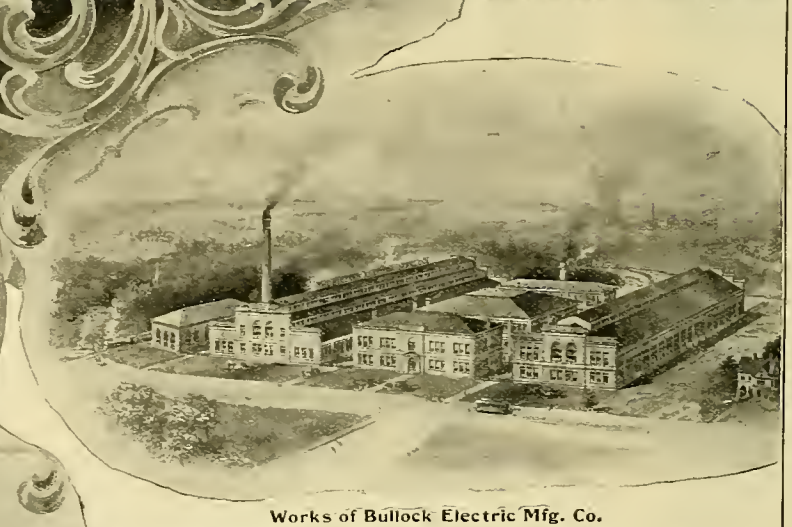
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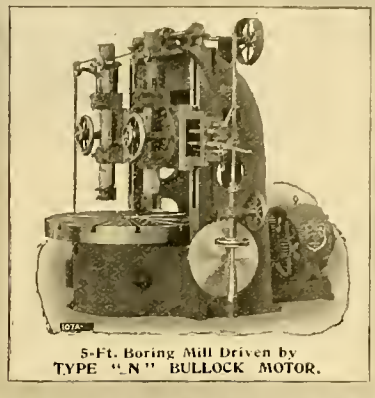

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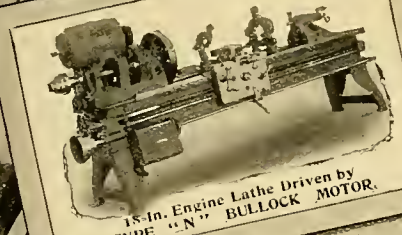

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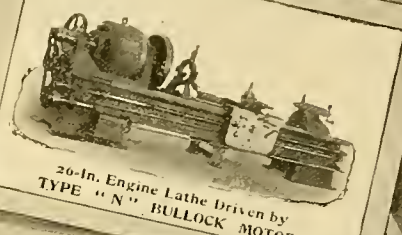

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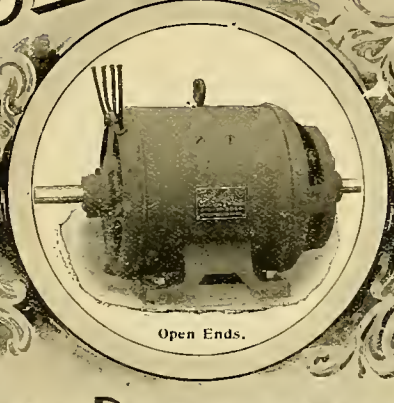

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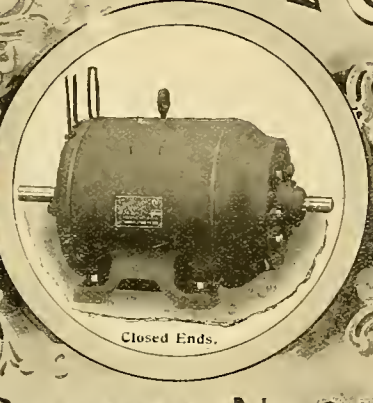

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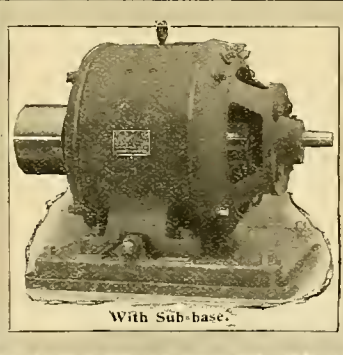

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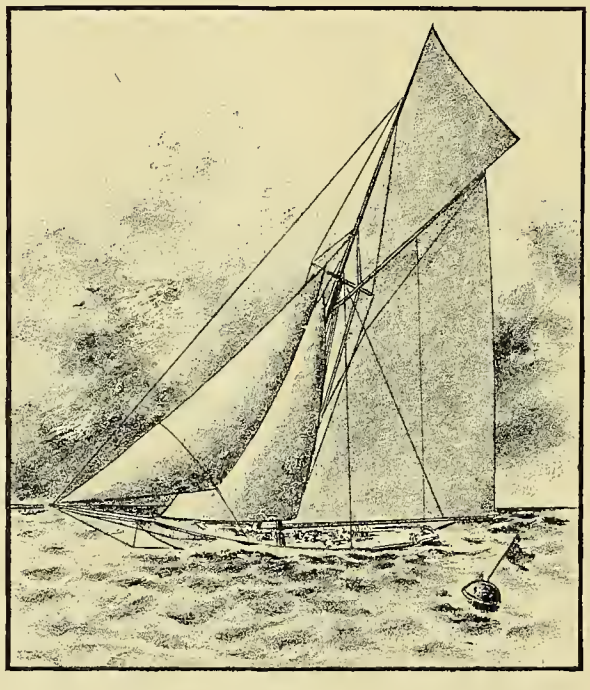

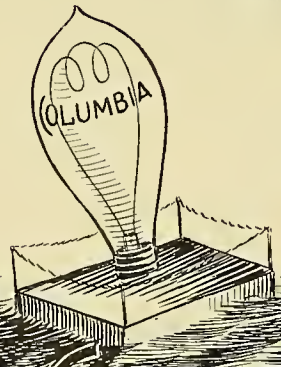

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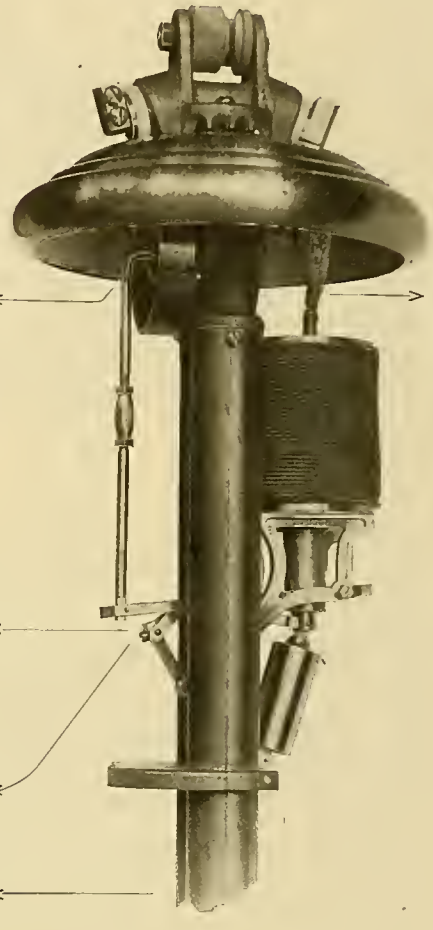

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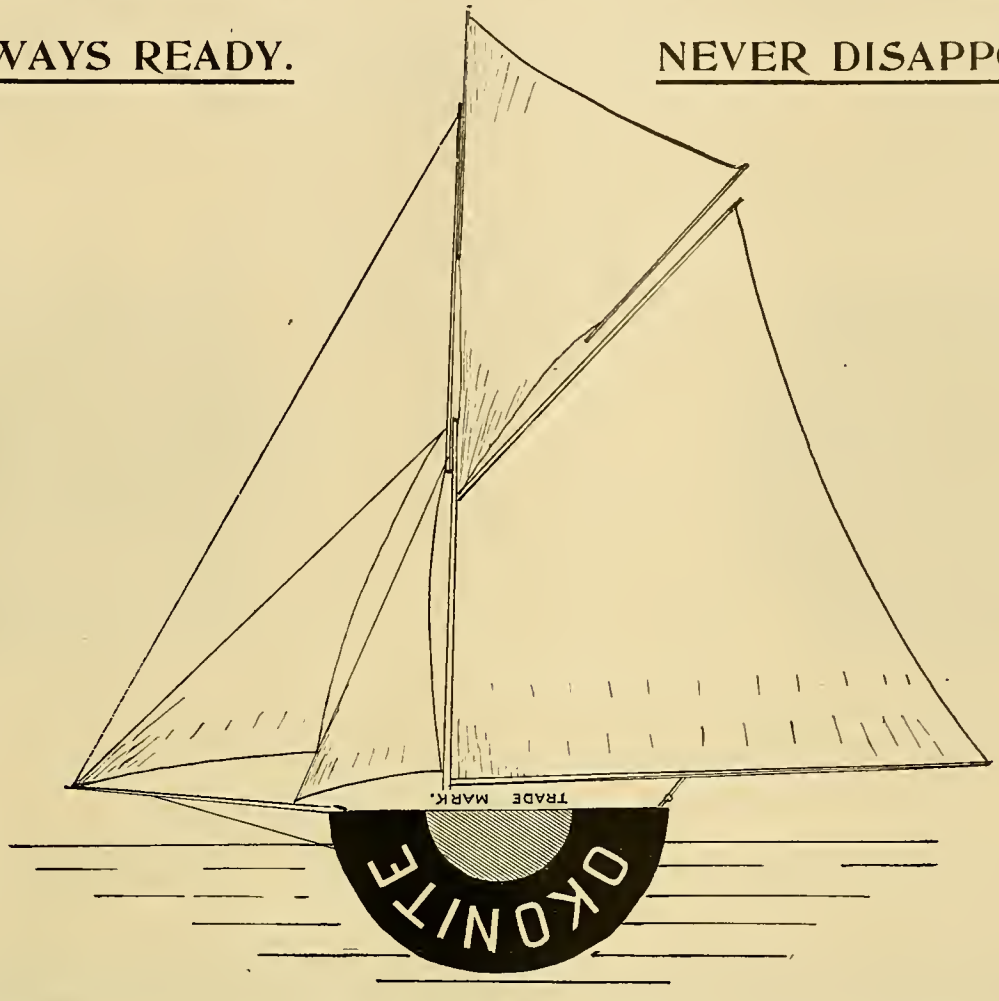

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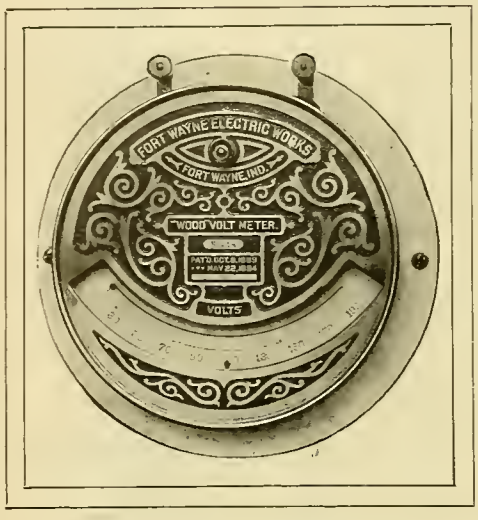

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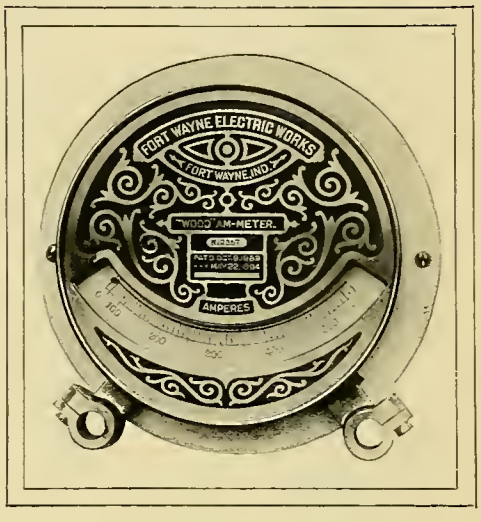

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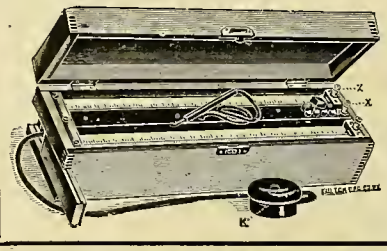

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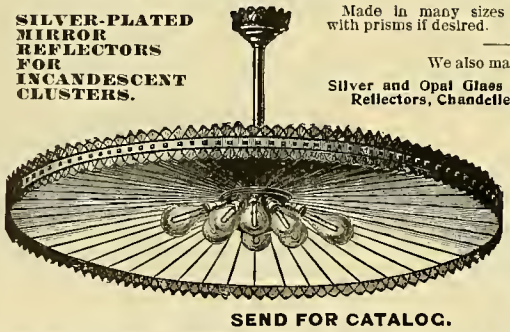

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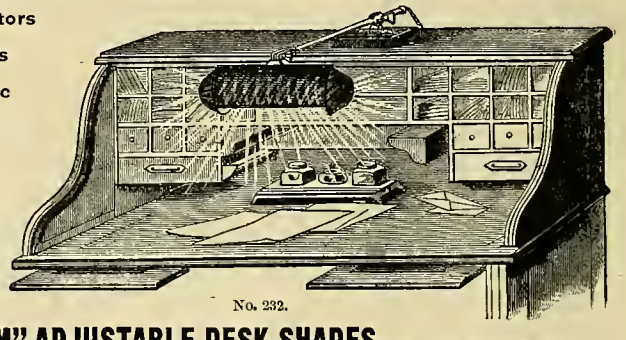

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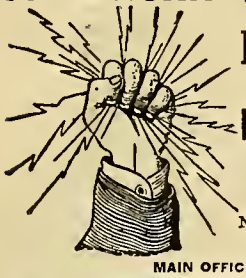

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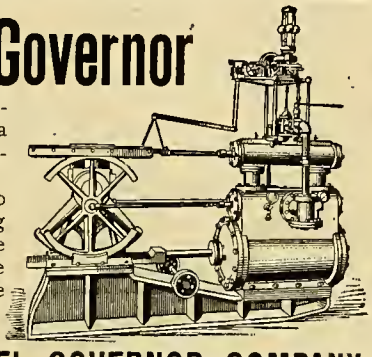

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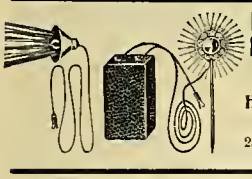

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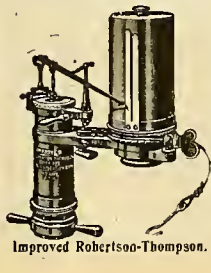

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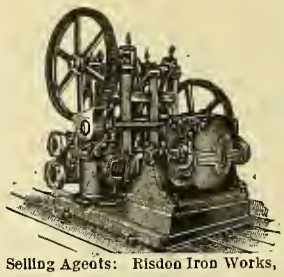

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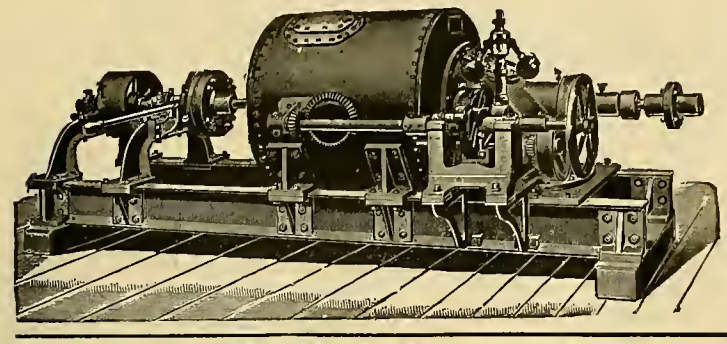

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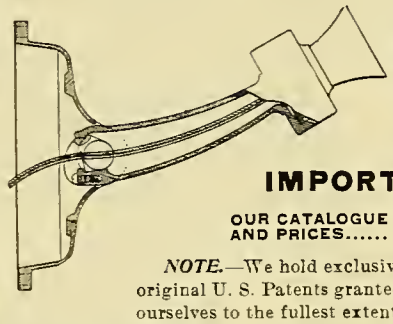

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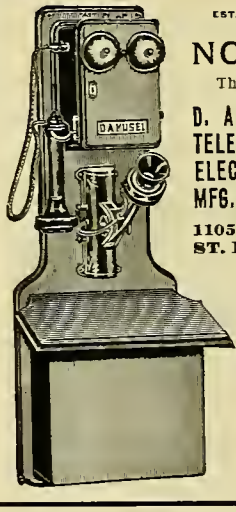

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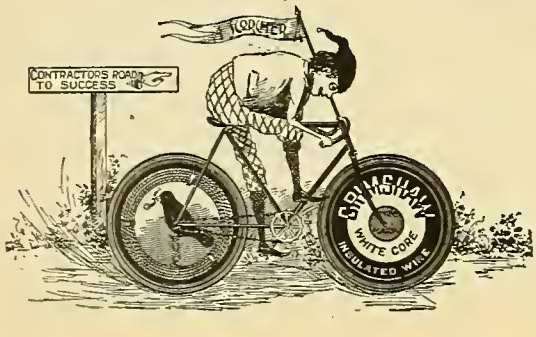

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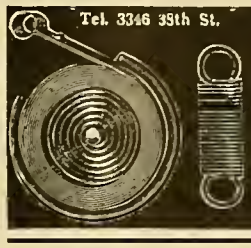

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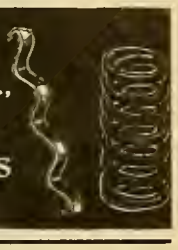

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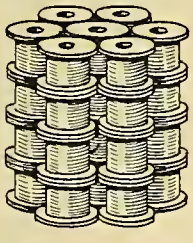

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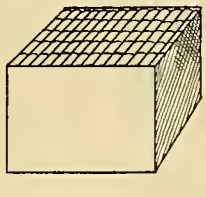

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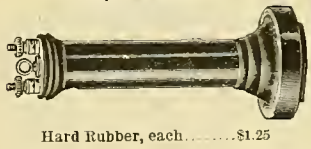

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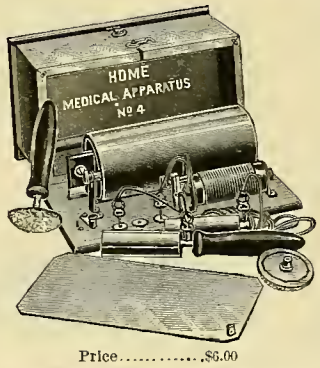

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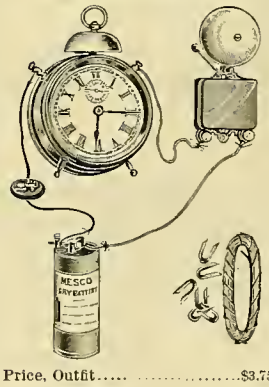

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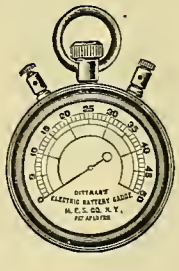

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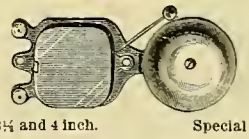

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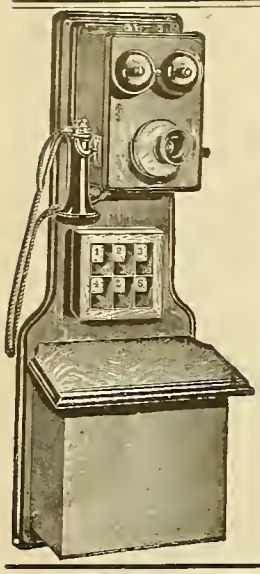

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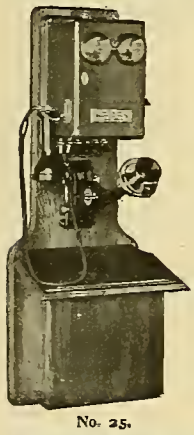

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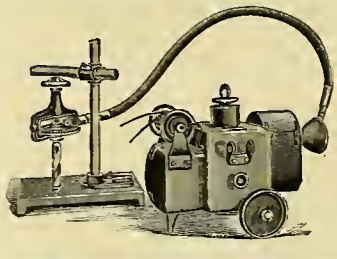

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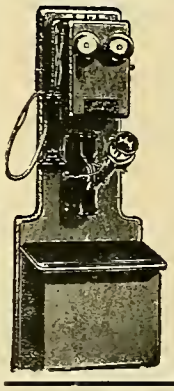

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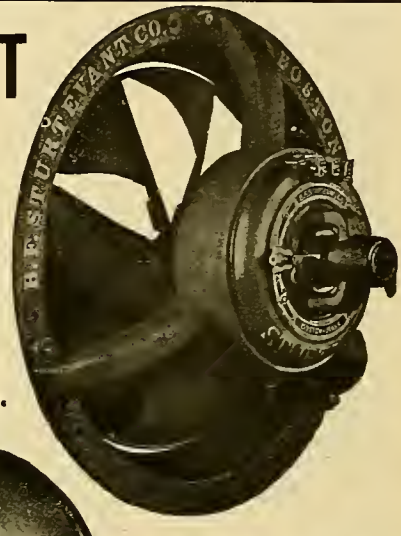

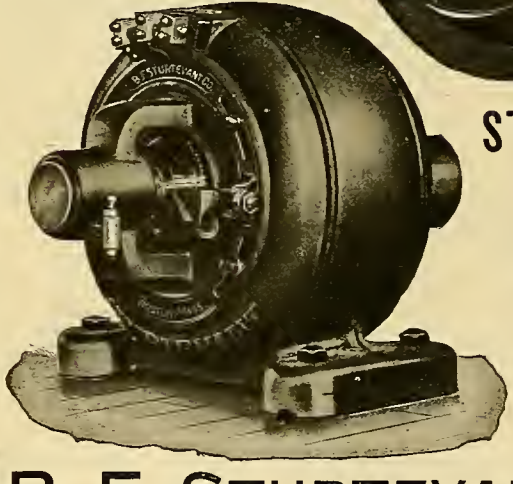

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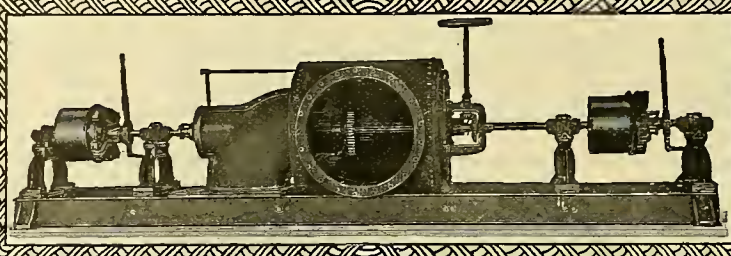

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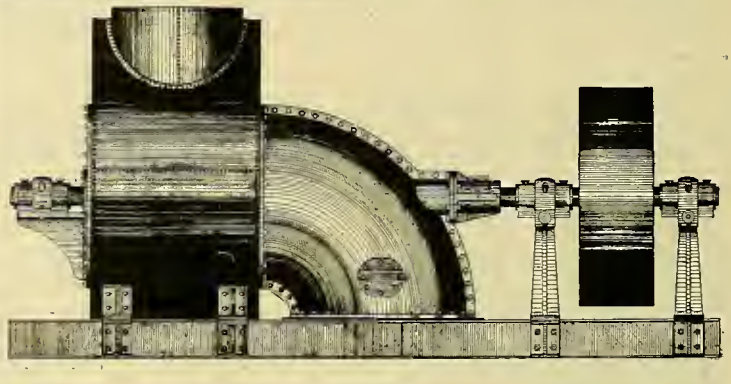

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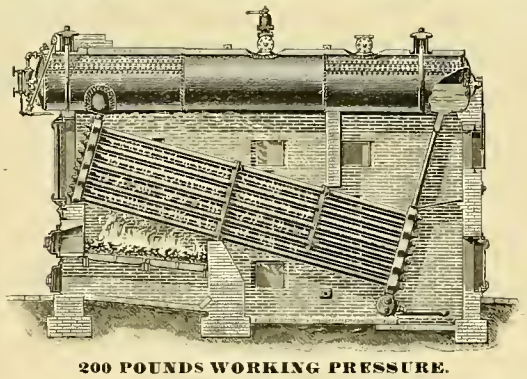

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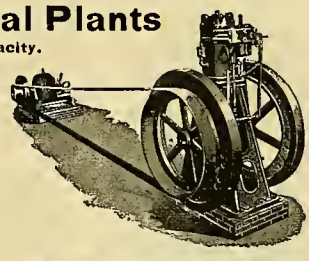

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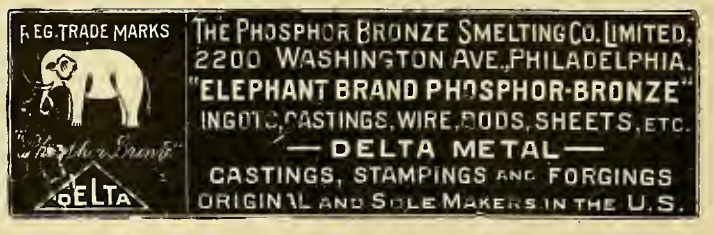

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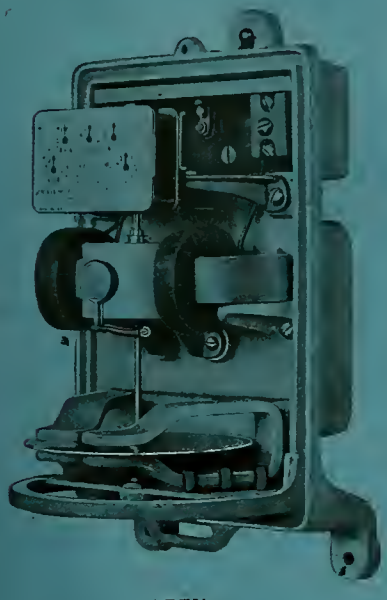

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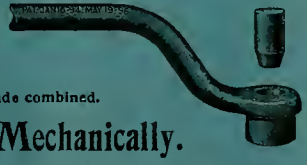

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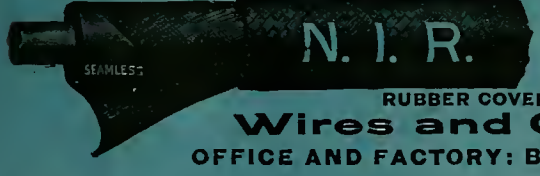

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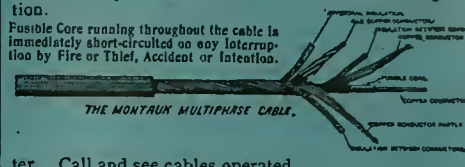

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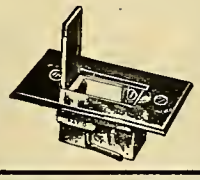

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Western Representatives: J. B. McKeague Co., 324 Dearborn St., Chicago.

CHICAGO INSULATED WIRE CO.

152-154 Lake St.

CHICAGO, ILL. U.S.A.

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We have the **Largest and Most Complete Electrical**

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

THE SEAL OF APPROVAL

Has been placed on the use of Automobiles by the high social factors of the country and another year no member of elite society will be up-to-date or strictly correct in every respect in his equipage unless he is the possessor of one or more Automobiles. Anticipating this, the **Woods Motor Vehicle Company** have developed and perfected beyond all further experiment under the Woods system of electrical propulsion correct styles for the coming year in over thirty different forms of vehicles, including Buggies, Traps, Brakes, Broughams, Victorias and Cabs, all of which are so simple in their operation and care that the same servants now employed can be retained, and in the lighter vehicles for ladies' and gentlemen's driving an hour's time is sufficient to learn their every manipulation.

Cost to run per mile, ½ cent. STANHOPE. Price, $2,000.00 net.

STANDARD OF THE WORLD.

Weight, 1,800 Pounds.

Mileage capacity, one charge, 35 miles.

Speed per hour, 12 miles.

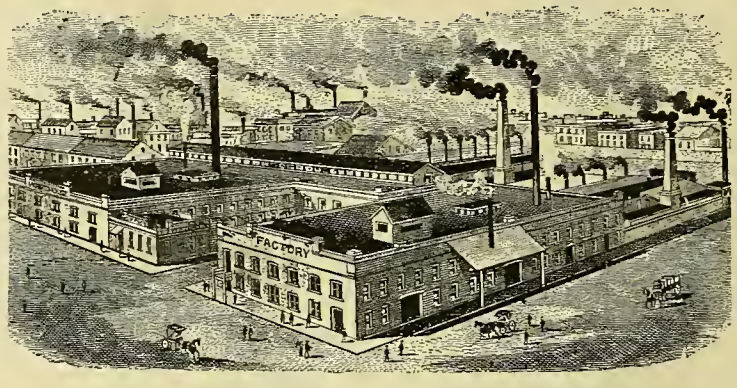
The Stanhope illustrated here fills in every particular the requirements of the fastidious carriage user, as it has every feature of refinement in design and style which constitutes a carriage and not a mere machine, and one of the greatest delights in store for ladies is the usage of this character of vehicle. We strongly recommend the placing of orders early this fall and winter for spring delivery in order to insure no delay in getting such vehicles for a full season's use next year. Send for book of magnificent illustrations in latest styles of Automobiles.

WOODS MOTOR VEHICLE COMPANY,

547-551 WABASH AVENUE, CHICAGO.

Vanderbilt Ave. and 44th St., New York. 14 King St., Toronto, Ont.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

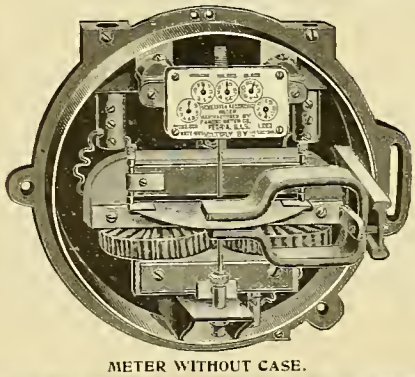
We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

SCHEEFFER RECORDING WATT-METERS.



METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,

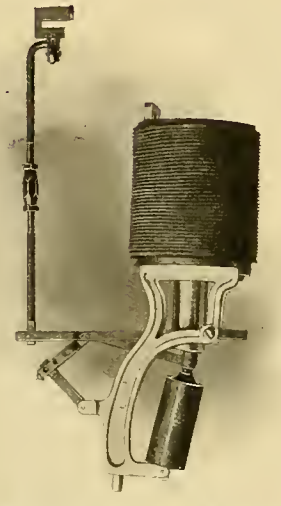
PEORIA, ILL., U. S. A.

METER WITH CASE.

THE BELDEN ARC LAMP

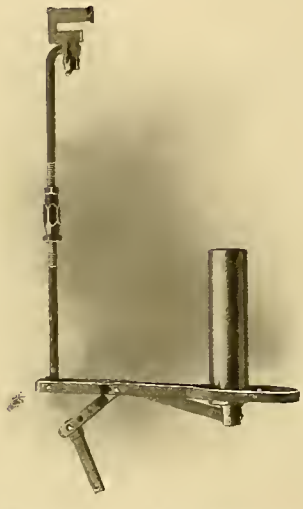
IS SUPERIOR TO OTHER LAMPS

BECAUSE



By Means of This Toggle

The carbons have a range of separation of over three times the distance at which they normally burn.



By Means of This Toggle

The magnet has an extraordinary leverage, thereby allowing the use of the heavy gravity pull.

Simple and light but very powerful mechanism.

Gives the largest possible life for one ½ in. x 12 in. carbon.

No alignment necessary.

Clutch releases itself without striking a trip-post of any kind.

No shadows cast from carbon points.

Absence of metal of any kind on inside of inner globe prevents chance of coloring ashes deposited on globe.

All springs usually employed in mechanism of arc lamps eliminated.

Permanent adjustment at all times regardless of changes of temperature.

No sliding contacts to corrode and cause trouble. No carbon rods.

No part of lamp (except globes) needs cleaning or polishing at any time, as parts cannot become corroded or dirty enough to interfere with proper working of lamp.

Short and very light in weight.

Has extraordinarily strong frame, built like a bicycle.

Trims as easily as an open arc lamp.

Lamp is so insulated that when current is on no uninsulated portion is exposed.

Easy access to working parts.

Long, steady and powerful pull of toggle produces no flickering.

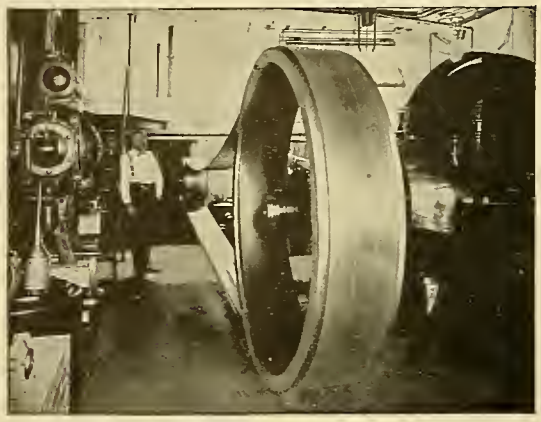
Danger-proof against fire.

If Interested send for Descriptive Catalog. See Illustrated Article in Western Electrician Issue October 28.

MANUFACTURED BY

BELDEN-LARWILL ELECTRIC & MFG. CO.,

FORT WAYNE, INDIANA, U. S. A.



BROWN, DURRELL & CO.

Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say.
Write Us.

CLING-SURFACE MFG. CO.,

177-182 VIRGINIA ST., BUFFALO, N. Y.

CHICAGO BRANCH: 225 Dearborn St.

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Belting.
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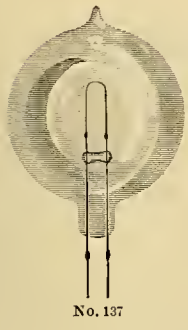
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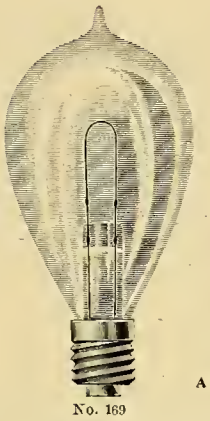
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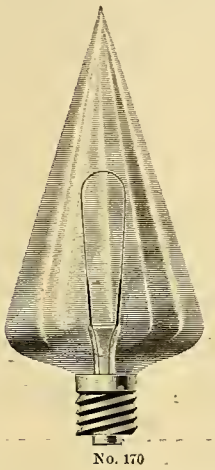
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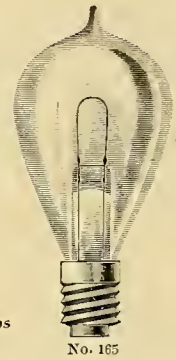
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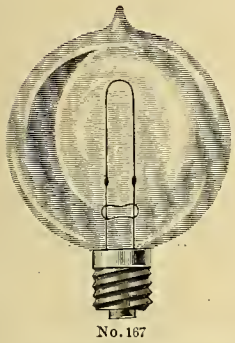
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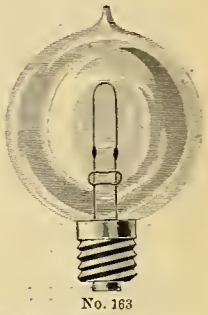
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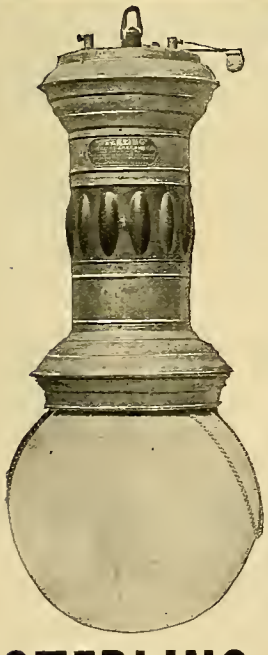

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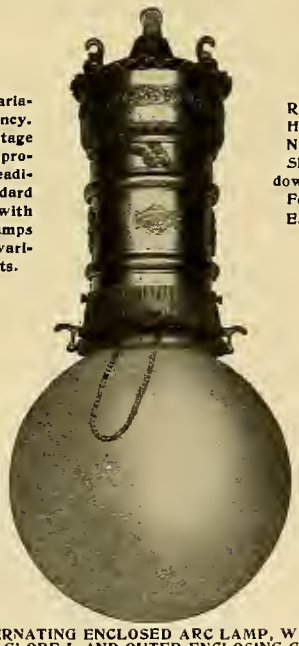

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For indoor and outdoor use.
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We make all sizes.

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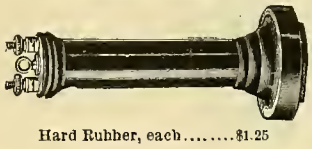

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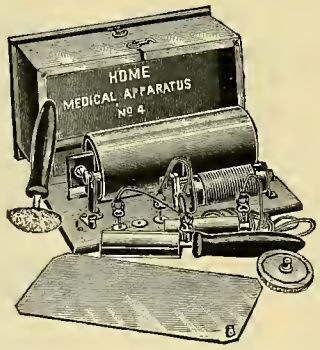

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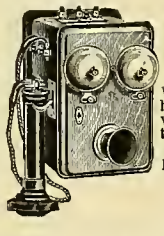

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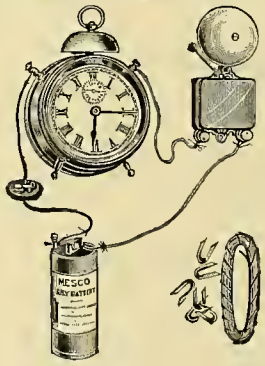

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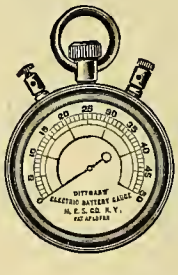

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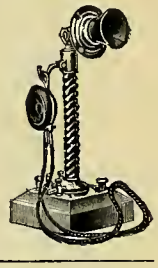

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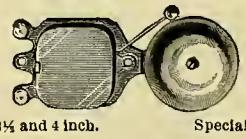

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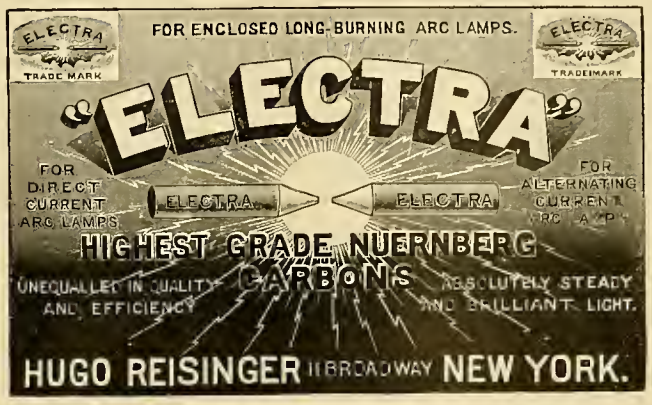

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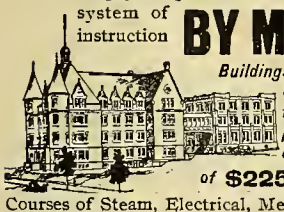

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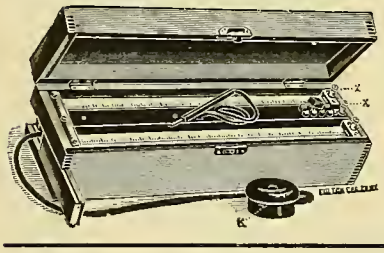

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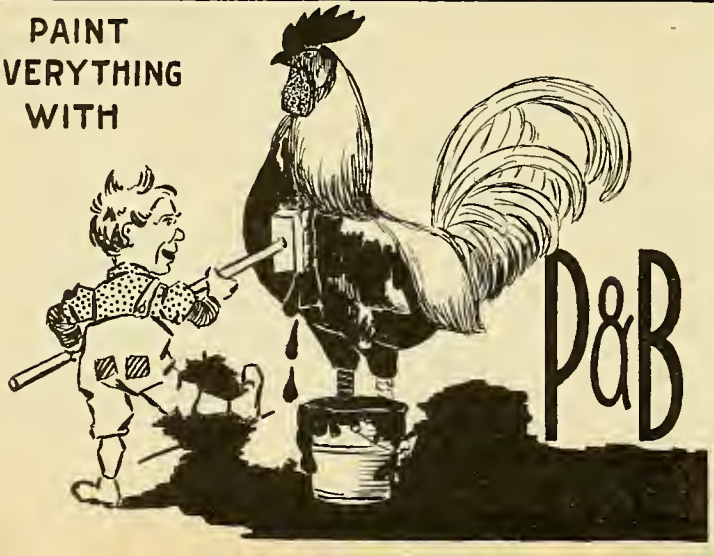

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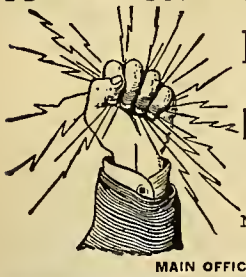

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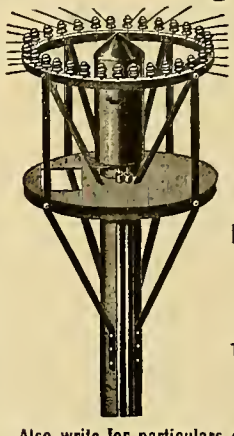

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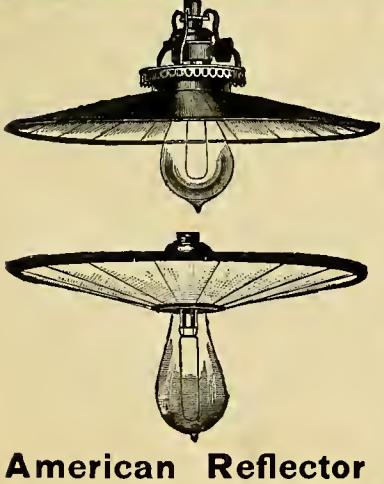

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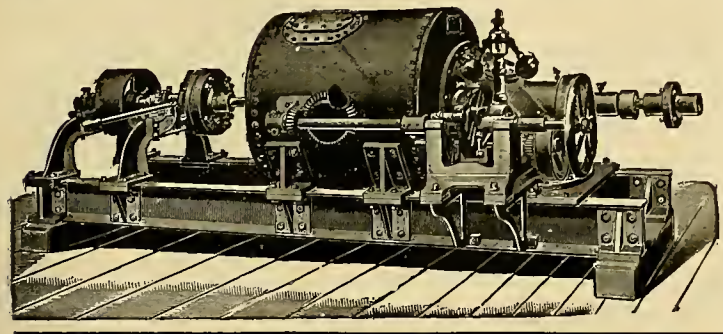

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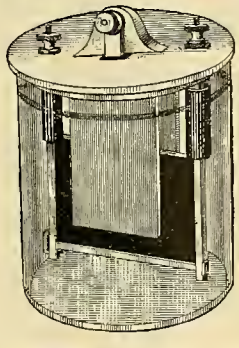

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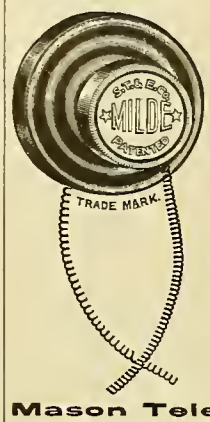

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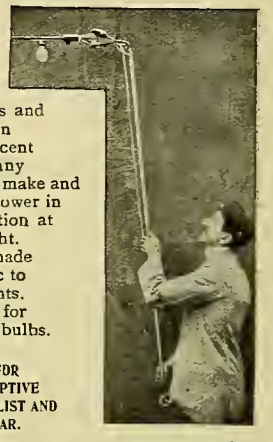

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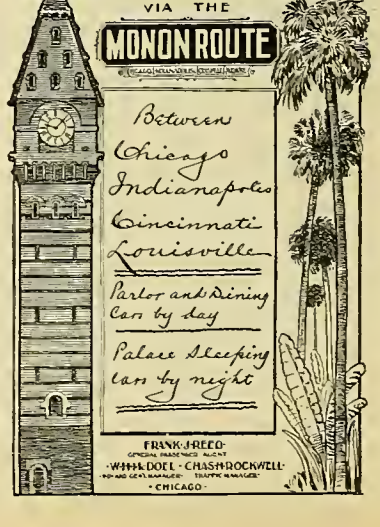

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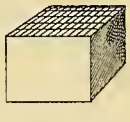

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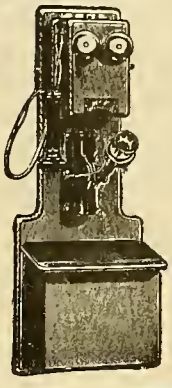

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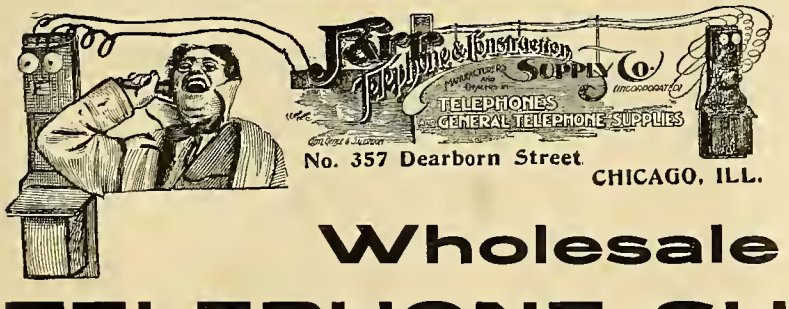

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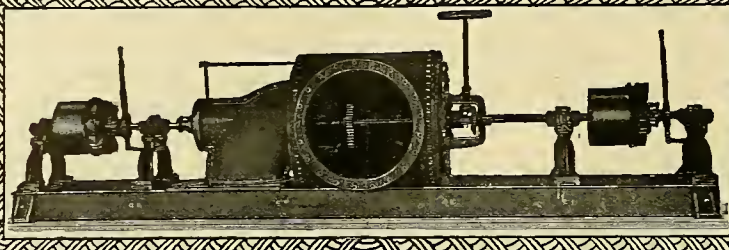

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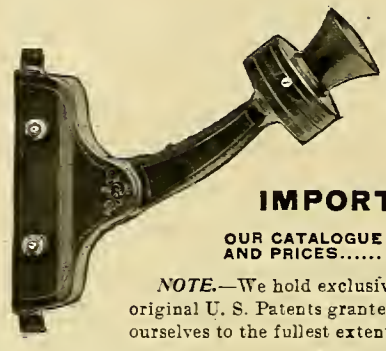

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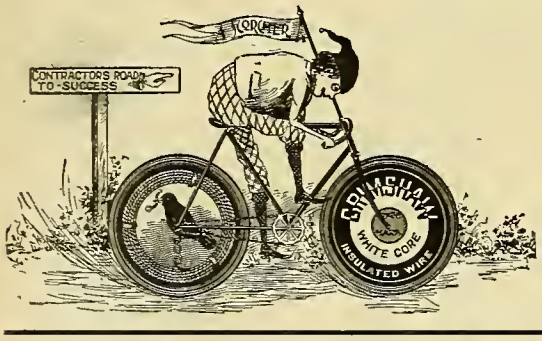

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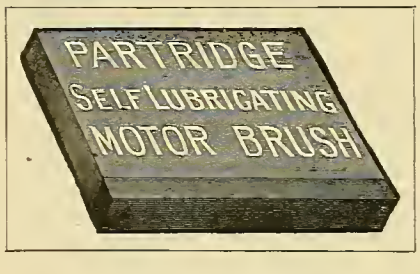

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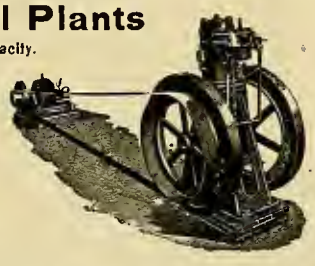

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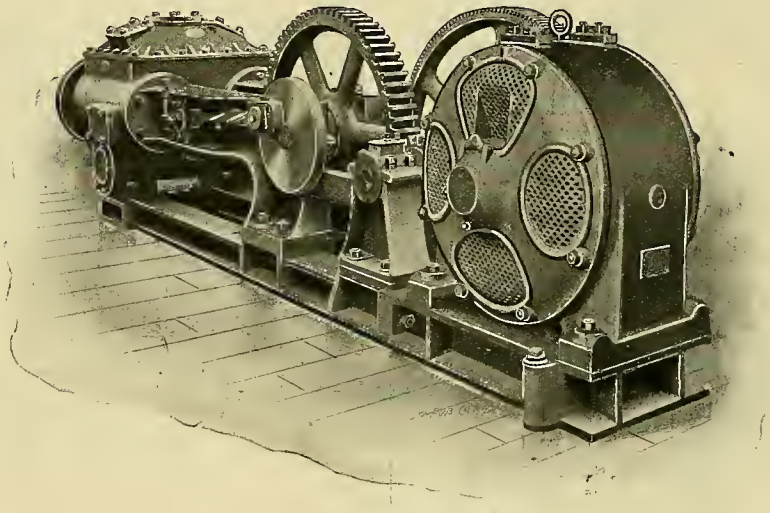

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Western Electrician.

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Vol. XXV. CHICAGO, NOVEMBER 11, 1899. No. 20

SIMPLEX INSULATED WIRES AND CABLES.

RUBBER COVERED, WEATHERPROOF, UNDERGROUND AND SUBMARINE.

WESTERN SELLING AGENT: M. R. MIXSON, 1107 Monadnock Block, CHICAGO.

Simplex Electrical Company, 75-81 Cornhill, BOSTON, MASS.

OKONITE TRADE MARK.

1889—Paris Exposition, Medal for Rubber Insulation.
1893—World's Fair, Medal for Rubber Insulation.

THE STANDARD FOR RUBBER INSULATION.

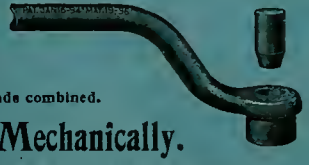
Sole Manufacturers of

Okonite Wires, Okonite Tape, Manson Tape, Candee Weatherproof Wires.

THE OKONITE CO., LTD.

Herd L. Candee, Managers. Herbert Cheever, 253 Broadway, New York. Geo. T. Manson, Gen'l Supt. W. H. Hodgins, Secy.

MORE "Crown" Rail Bonds



Are in use than all other styles of Rail Bonds combined.

Perfect—Electrically and Mechanically.

VARIETY OF SHAPES TO MEET ALL REQUIREMENTS OF RAIL BONDING.

WASHBURN & MOEN Dept.,

American Steel & Wire Co.,

The Rookery, CHICAGO, ILL.

Standard Underground Cable Co.

542 The Rookery, Chicago. Westinghouse Bldg., Pittsburg. 507 Security Building, St. Louis, Mo. 18 Cortlandt St., New York City. 1225 Betz Bldg., Philadelphia, Pa.

Electric Cables, Conduits, Wires and Accessories,

Also High Grade Rubber Covered Wires and Cables.

25% DIVIDEND.

The rebate we allow on burned-out lamps when either New or Renewed lamps are ordered from us is a 25 per cent. dividend to you.

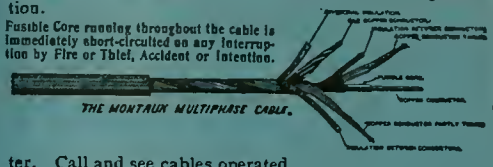
If you want this dividend write us and we will tell you how to get it.

LYNN INCANDESCENT LAMP CO., LYNN, MASS.

The Only Fire Detective Cable in the World.

Every Fractional Part of which is continuously Thermostatic, and designed for all Interior Electric Wiring Adaptations. It lights the gas! Rings the door bells! It automatically notifies of fire and indicates that burglars are at work, all in one installation.

Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, Accident or Intention.



THE MONTAUK MULTIPHASE CABLE.

Why use dormant wires? The Montauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human being is to the touch of flame.

Write for descriptive matter. Call and see cables operated.

MONTAUK MULTIPHASE CABLE CO.,

Telephone 4031 Cortlandt. 100 Broadway, NEW YORK.

2,000 IN USE.

Bipolar and Multipolar Motors from ½ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

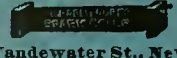
Queen & Co.,

1012 Chestnut St., PHILADELPHIA.

Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils

C. F. SPLITDORF,

X-Ray Coils, Telephone Coils.



Medical Coils, Spark Coils.

17-27 Vandewater St., New York.

THE PHOENIX GLASS CO.

MANUFACTURERS OF

GAS AND ELECTRIC GLOBES, SHADES, Etc.

HAVE YOU A COPY OF OUR No. 8 CATALOGUE? IF NOT, SEND FOR IT.

Pittsburgh. New York. Chicago.

Chicago Belting Company

MAKERS OF LEATHER BELTING — RELIANCE — DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

The production of our Dynamo brand of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and in all climates.

When ordering Dynamo Belting always state the system used.

OFFICE AND FACTORY: 67-69 SOUTH CANAL STREET CHICAGO, ILL.

NEW ORLEANS ST. LOUIS

I-T-E CIRCUIT BREAKERS

CUTTER ELECTRICAL CO., PHILADELPHIA

THE BEST ON EARTH

TIPLESS LAMPS THE SHELBY ELECTRIC CO. SHELBY, OHIO.

WESTON Electrical Instrument Co.,

114 120 William St., NEWARK, N. J., U. S. A.

Weston Standard Portable Alternating and

The Weston Standard Portable Direct Reading Voltmeters and Wattmeters

FOR

Alternating and Direct Current Circuits.

Are the only standard portable instruments of the type deserving this name. Write for circular and price lists 8 and 9.

Mention the WESTERN ELECTRICIAN when

LAVA LAVA LAVA

WASHERS. BUSHINGS. THREADED PIECES.

Combine High Heat Resistance with BEST INSULATING QUALITY.

Send drawing or model for estimate.

D. M. STEWARD MFG. CO.,

107 Chambers St., NEW YORK. CHATTANOOGA, TENN.

INSULATE ARMATURES WITH PAINT OR VARNISH ACCORDING TO CHEMICAL LAW INSTEAD OF BY HABIT. NOWHERE ARE EXPERIMENTS ON ARCHAIC METHODS SO WASTEFUL

MASSACHUSETTS CHEMICAL CO. BOSTON, U.S.A.

A WONDERFUL ALL METAL RECEIVER NEEDS NO ADJUSTING STANDS THE TEST IN

ERICSSON BI-POLAR SWEDISH RECEIVER

IT IS THE BEST WHY NOT HAVE IT?

ERICSSON TELEPHONE CO.

THE BELDEN ARC LAMP

IS SUPERIOR TO OTHER LAMPS

BECAUSE

By Means of This Toggle

The carbons have a range of separation of over three times the distance at which they normally burn.

By Means of This Toggle

The magnet has an extraordinary leverage, thereby allowing the use of the heavy gravity pull.

Simple and light but very powerful mechanism.

Gives the largest possible life for one ½ in. x 12 in. carbon.

No alignment necessary.

Clutch releases itself without striking a trip-post of any kind.

No shadows cast from carbon points.

Absence of metal of any kind on inside of inner globe prevents chance of coloring ashes deposited on globe.

All springs usually employed in mechanism of arc lamps eliminated.

Permanent adjustment at all times regardless of changes of temperature.

No sliding contacts to corrode and cause trouble. No carbon rods.

No part of lamp (except globes) needs cleaning or polishing at any time, as parts cannot become corroded or dirty enough to interfere with proper working of lamp.

Short and very light in weight.

Has extraordinarily strong frame, built like a bicycle.

Trims as easily as an open arc lamp.

Lamp is so insulated that when current is on no uninsulated portion is exposed.

Easy access to working parts.

Long, steady and powerful pull of toggle produces no flickering.

Danger-proof against fire.

If Interested send for Descriptive Catalog. See Illustrated Article in Western Electrician Issue October 28.

MANUFACTURED BY

BELDEN-LARWILL ELECTRIC & MFG. CO.,

FORT WAYNE, INDIANA, U. S. A.

The Best Testimony is a Duplicate Order.

THE UNION TRACTION CO. OF PHILADELPHIA INSTALLED ITS FIRST BATTERY OF

CHLORIDE ACCUMULATORS

IN JULY, 1896, AND HAS RECENTLY CONTRACTED FOR FOUR ADDITIONAL BATTERY PLANTS.

THE ELECTRIC STORAGE BATTERY CO., PHILADELPHIA, PA.

SALES OFFICES:

New York, 100 Broadway. Boston, 60 State St. Baltimore, Equitable Building. Chicago, Marquette Building. San Francisco, The Parrott Building.

EAGLE INSULATING VARNISH. Best made, light colored, remains elastic. Send for sample and be convinced.

Eagle Paint & Varnish Works, PITTSBURG, PA.

This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. **Guarantees Satisfaction**

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.

"Willey" Multipolar DYNAMOS AND MOTORS.

SEMI-ENCLOSED TYPE, FOR DIRECT CONNECTION.

Manufactured by

JAMES CLARK, JR., & CO., 313 West Main St., Louisville. Ky.

Correspondence solicited.

BULLOCK GENERATORS. SEND FOR BULLETIN 2232 & 2234 BULLOCK ELECTRIC MFG. CO., CINCINNATI, O., U. S. A.

BULLOCK MOTORS. SEND FOR BULLETIN 2232 & 2233 BULLOCK ELECTRIC MFG. CO., CINCINNATI, O., U. S. A.

INCANDESCENT LAMPS

THAT MAINTAIN THEIR CANDLE POWER AND PRODUCE A PURE WHITE LIGHT, BECAUSE THEY HAVE A PERFECT

VACUUM

Made of the Highest Grade Materials, and by latest process known. Quality Guaranteed.

Prices F. O. B., Owensboro, Ky, 8, 10, 16 C. P., Bbl. Lots, 17c. each. 32 C. P., Bbl. Lots, 25c. each. Either E., T. H. or W. H. Bases.

TRY A BARREL AND BE CONVINCED.

MANUFACTURED BY

KENTUCKY ELECTRICAL CO., INCORPORATED, OWENSBORO, KENTUCKY.

THE REAL THING!

PAILLARD NON-MAGNETIC WATCHES

ENDORSED BY THE GREATEST ELECTRICIANS AND SCIENTISTS OF THE WORLD.

A USEFUL GIFT!

NO MORE USEFUL OR WELCOME GIFT COULD BE DESIRED. IT'S A GOOD THING TO HAVE YOURSELF.

FOR DESCRIPTIVE CIRCULAR WRITE

A. C. BECKEN

103 STATE ST. CHICAGO.

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FOREIGN AND DOMESTIC

CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 ADAMS STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

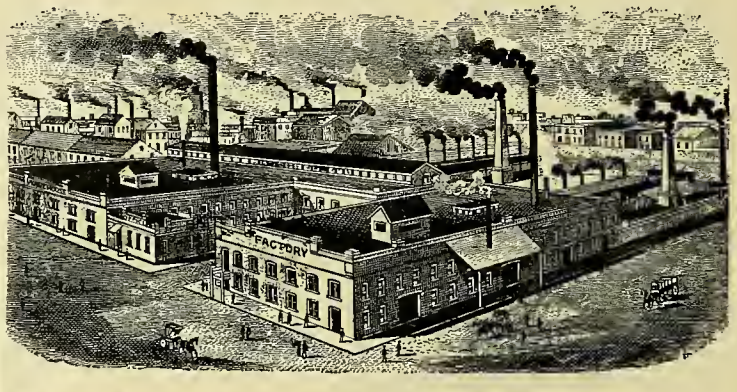
If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

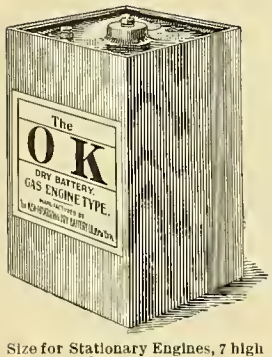
We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,
ST. LOUIS, MO.

O K DRY BATTERY,

NEW GAS ENGINE TYPE.



Size for Stationary Engines, 7 high by 4¼ square.
Size for Automobiles, 7 high by 4 square.

THE PROBLEM SOLVED.

No Solution to slop over. No Missing of sparks.
Highest Voltage.
Quickest Recuperation. Long Life.
Unaffected by heat or cold. Compactness.

BOXED, CONNECTED, COMPLETE, READY TO BE HITCHED TO ENGINE.

POINTS IN ORDERING.

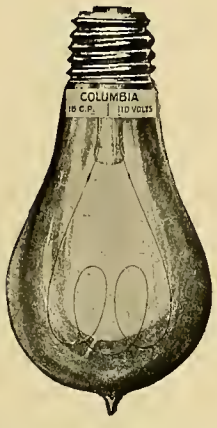
1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.

NON-POLARIZING DRY BATTERY CO., 625 BROADWAY, NEW YORK.

COLUMBIA LAMPS

FROM STOCK

IN ALL USUAL VOLTAGES AND CANDLE POWERS.



FOR STANDARD SOCKETS SEND US YOUR HURRY ORDERS

Central Electric Company,

264-270 FIFTH AVENUE, CHICAGO.

OKONITE
IT NEVER DISAPPOINTS

Federal Batteries
Using... Federal Salt

ARE STRONGER THAN ANY

Salammoniac Cell...In the World.

Initial Voltage 1.6 to 1.8.

FEDERAL SALT

USED IN

Carbon Cylinder Batteries

GIVES

33 MORE E. M. F.
AND **33 LONGER LIFE**
THAN SALAMMONIAC.

Absolutely no crystalizing Salts.

ESPECIALLY ADAPTED

TELEPHONES, HOUSE BELLS,
RAILROAD SIGNALS AND ALL
HARD OPEN-CIRCUIT WORK.

MADE BY

FEDERAL BATTERY COMPANY,

11 PINE STREET,

ALL DEALERS. NEW YORK.

CATALOGUE No. 11 NOW READY, 352 PAGES.

MANHATTAN ELECTRICAL SUPPLY CO.

32 Cortlandt Street, NEW YORK.

1,000,000 sold during the past twelve months.

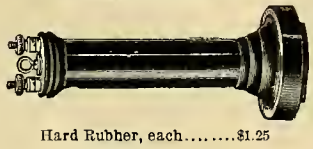
Mesco Dry Battery.

Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2⅛x6⅛
We make all sizes.

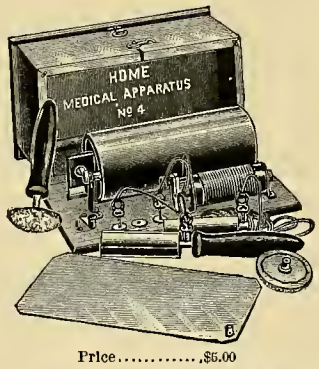
Telephone Receivers.



Hard Rubber, each.....$1.25

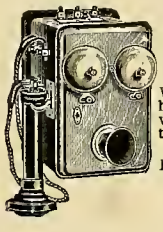
Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....,$5.00

We make a number of different styles.

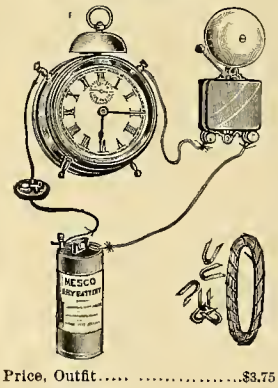


Telephone Outfit, No. 14,

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

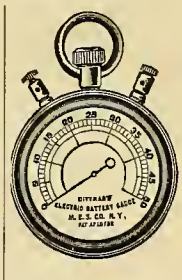
Alarm Clock Outfit, No. 1½.



Price, Outfit.....$3.75
" Clock only..... 2 25

Pony Telephone Receiver.

Retail price, 90 cents.



Dittmar Pocket Battery Gauge.

Will register the strength of open or closed circuit batteries.

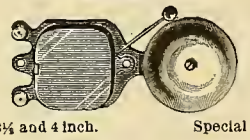
Price each, $3.50.

Desk Telephone Outfit, No. 11.

Price.....$9.00

We make a dozen different Telephone Outfits.

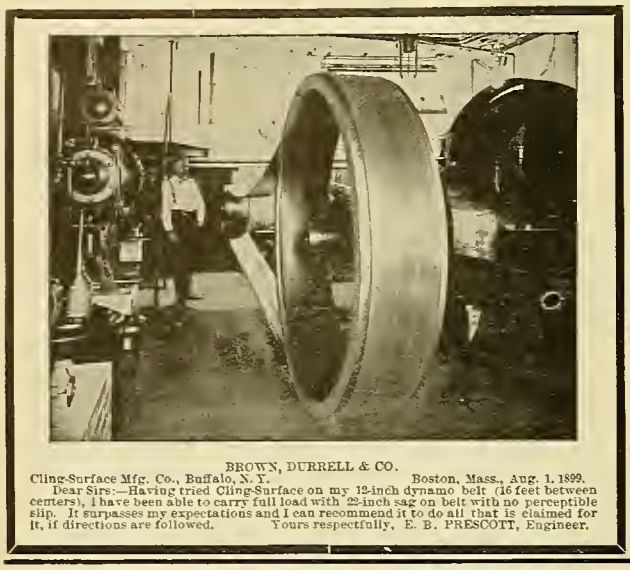
Iron Box Bells, No. 97.



2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.



BROWN, DURRELL & CO.

Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

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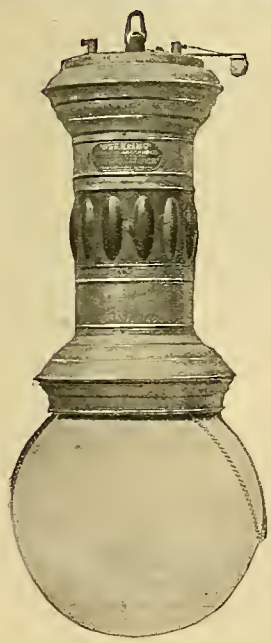

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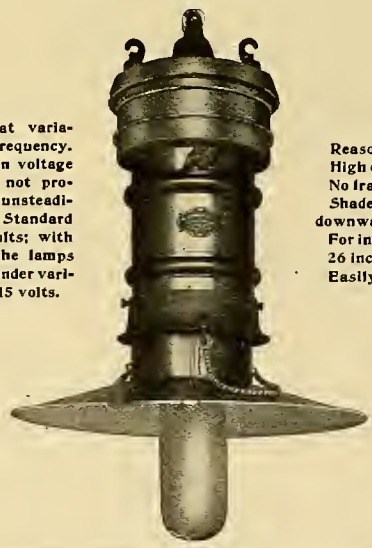

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Shade reflects upward rays downward.
For indoor and outdoor use.
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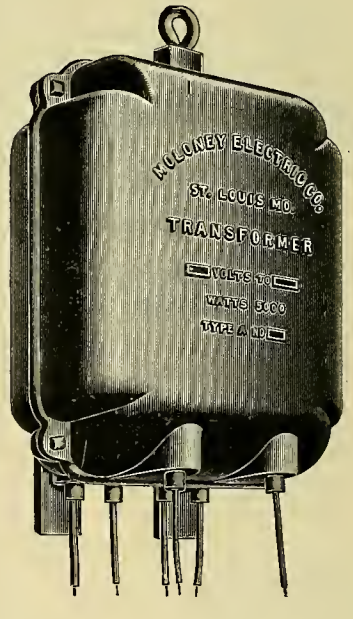

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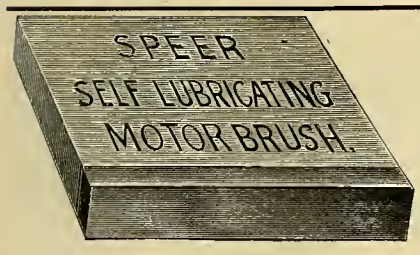

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For some time previous to enrolling in the Schools I had been reading everything I could get pertaining to mechanical and electrical engineering, but found that I needed a better education in mathematics. When I enrolled in the Electrical Engineering Course I was second engineer of the Topeka Railway Company. About one year afterwards, I was promoted to the position of chief engineer at a much larger salary.

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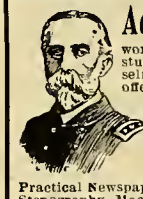

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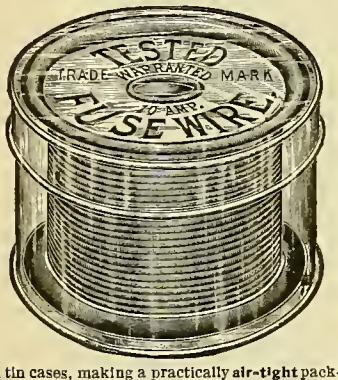

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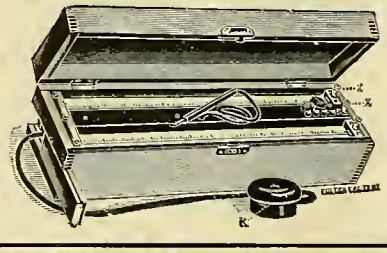

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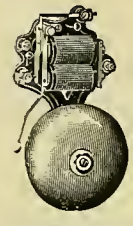

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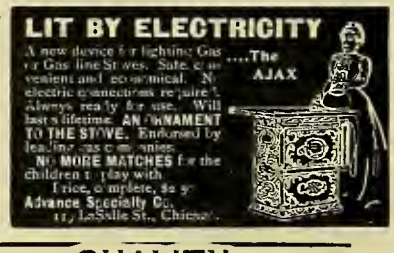

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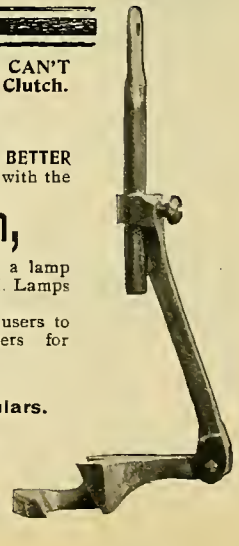

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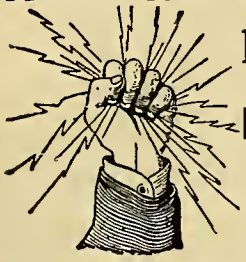

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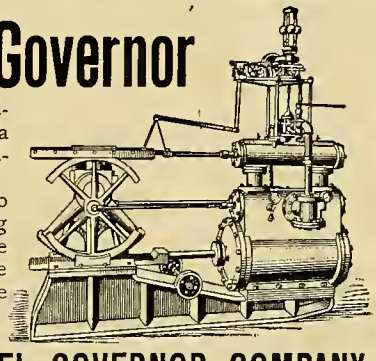

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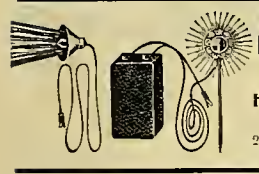

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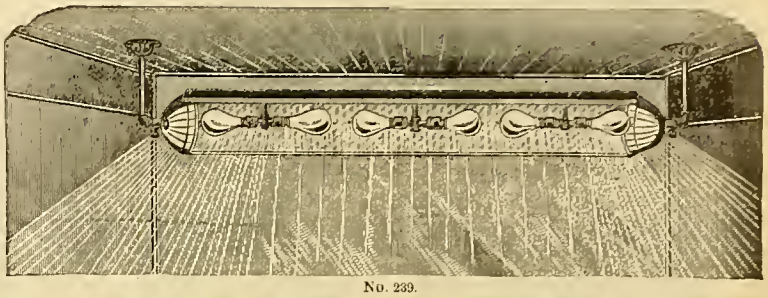

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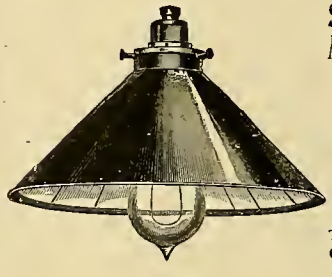

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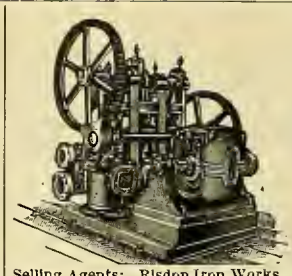

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300,000 feet, gauges 14 to 0000	35,000 lbs., gauges 14 to 0000

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Also 10,000 burnt-out lamps. Price on application.

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We have the following solid iron cluster halls:

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Also—Knife and Snap Switches, Cut-Outs, Plugs, Insulators, Lightning Arresters, Ribbon Fuses, Carbons, in fact everything electrical.

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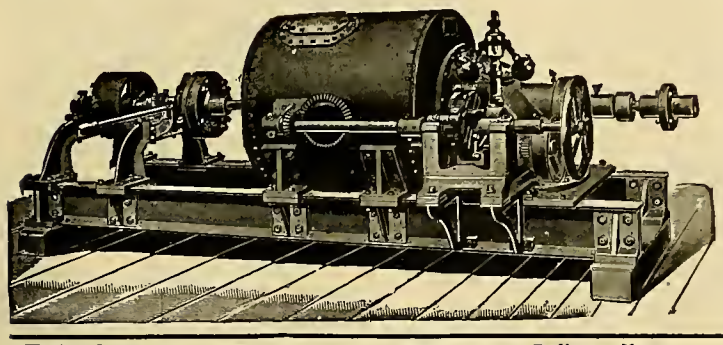

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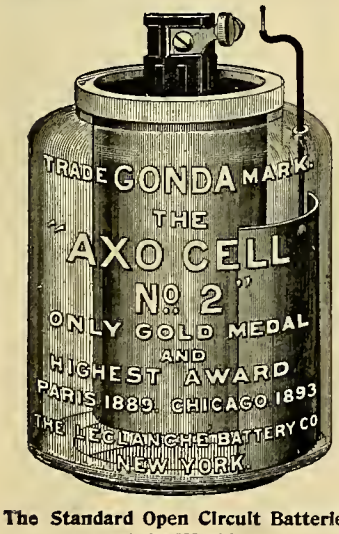

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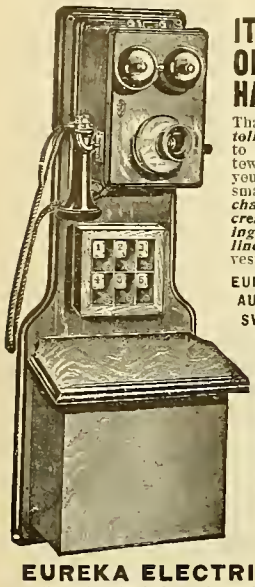

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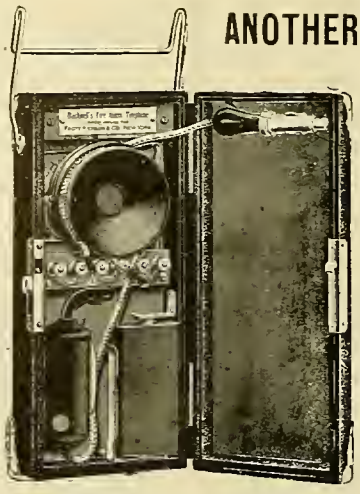

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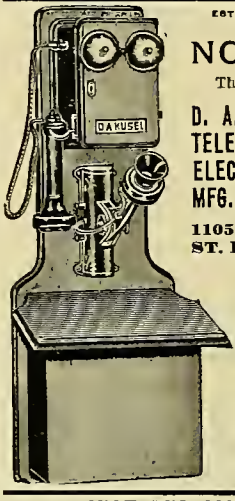

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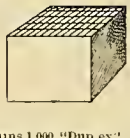

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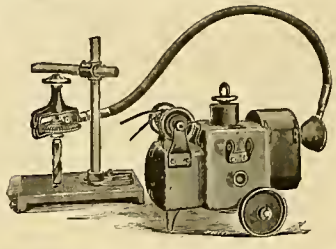

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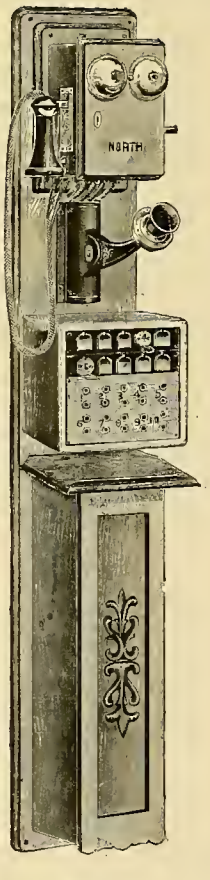

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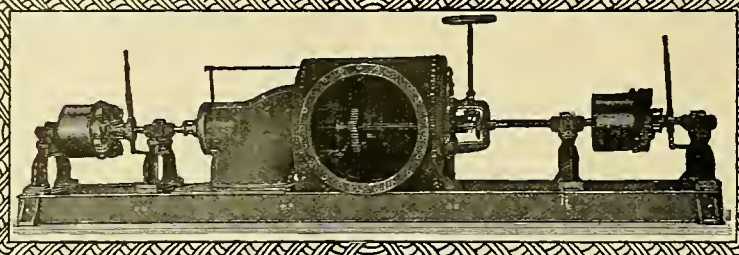

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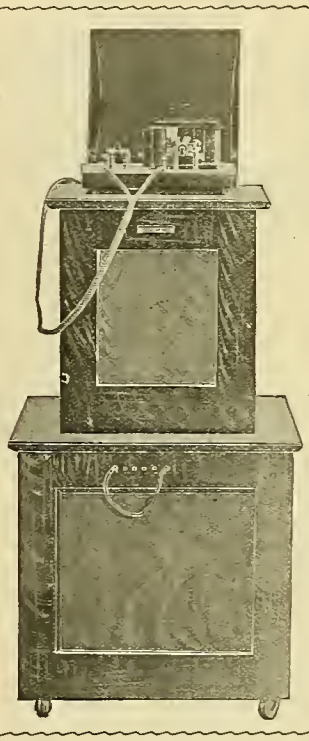

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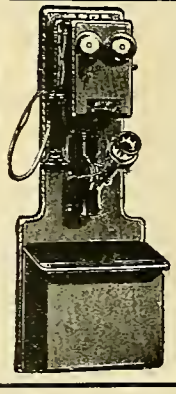

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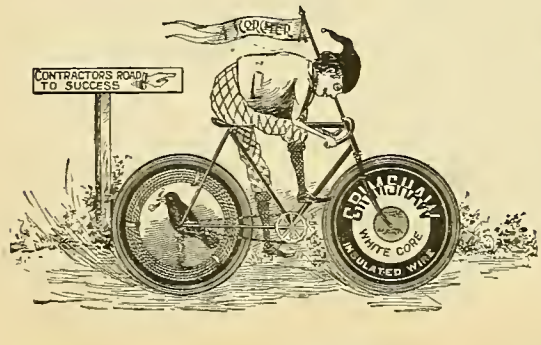

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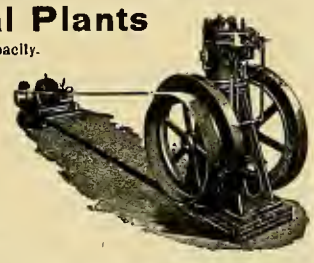

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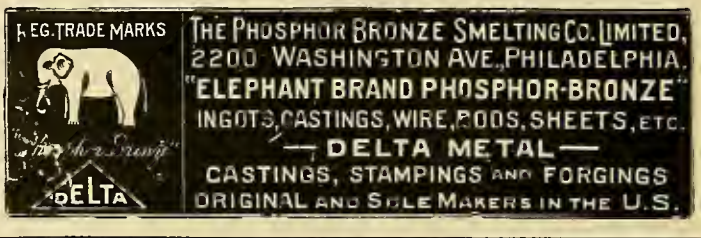

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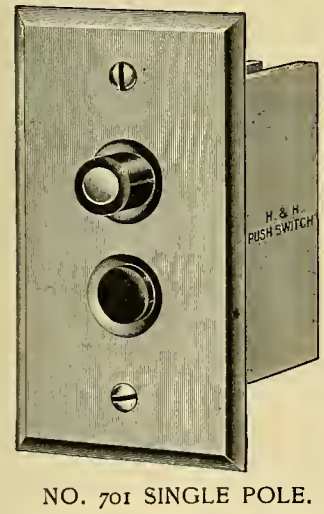

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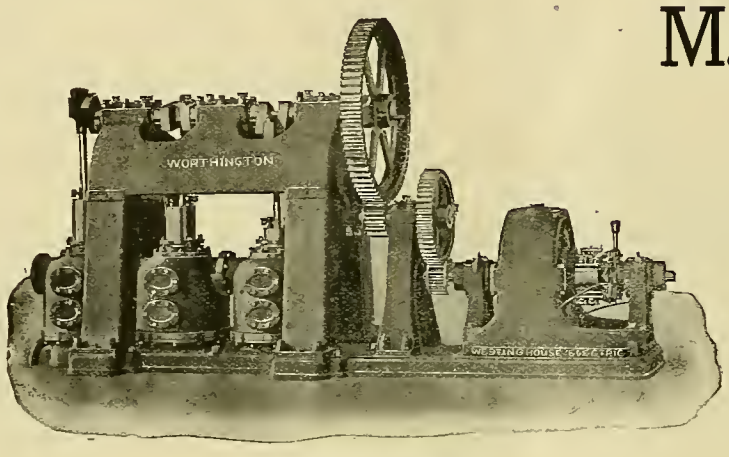

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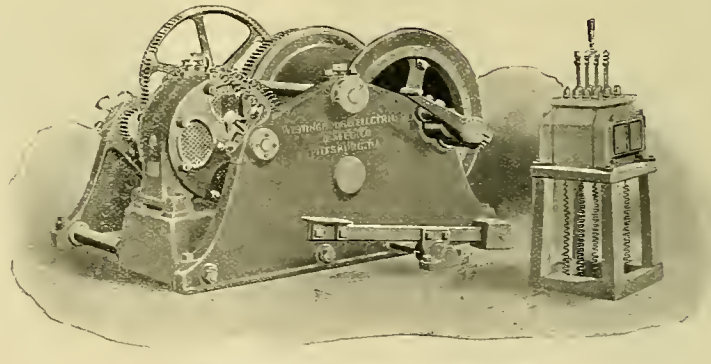

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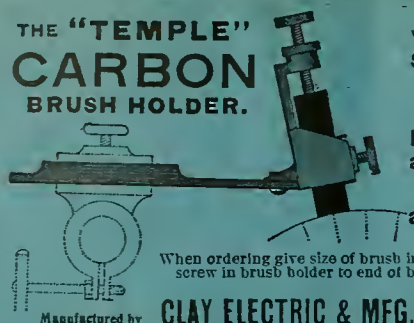

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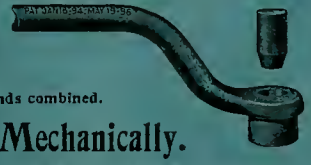

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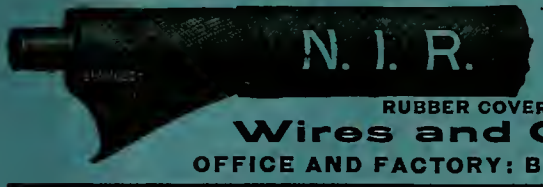

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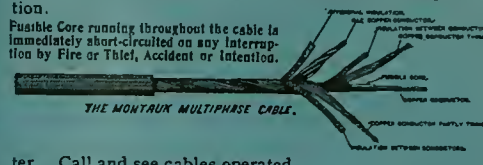

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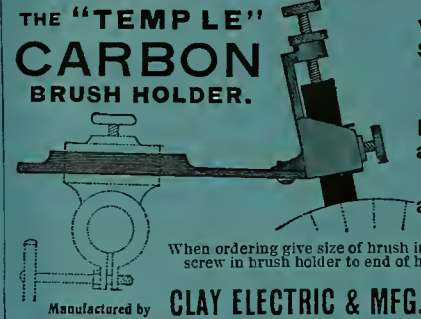

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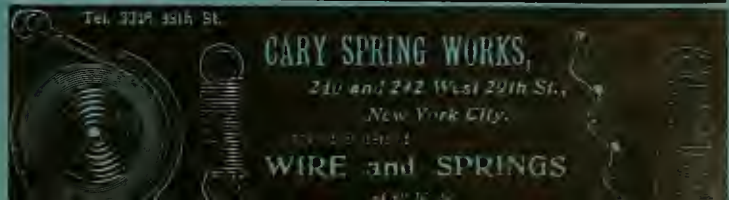

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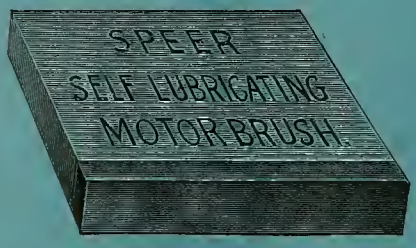

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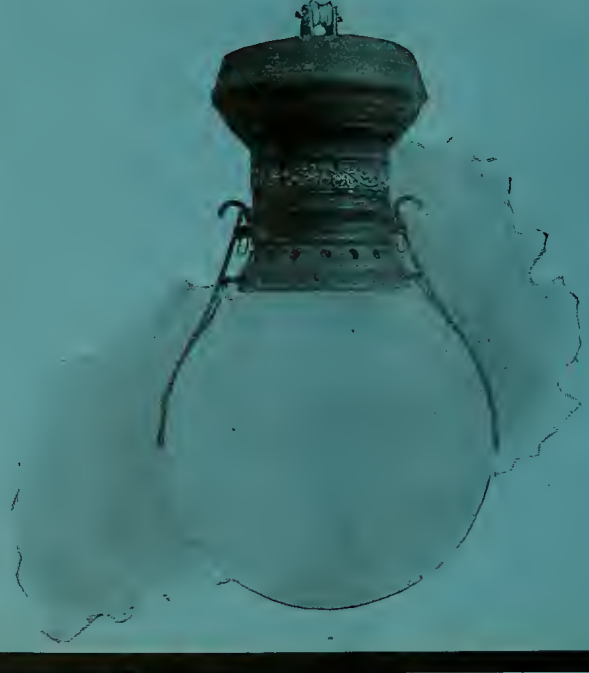

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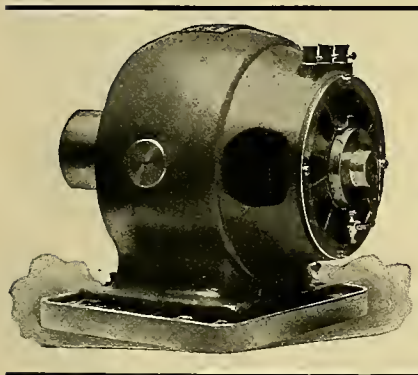

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REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

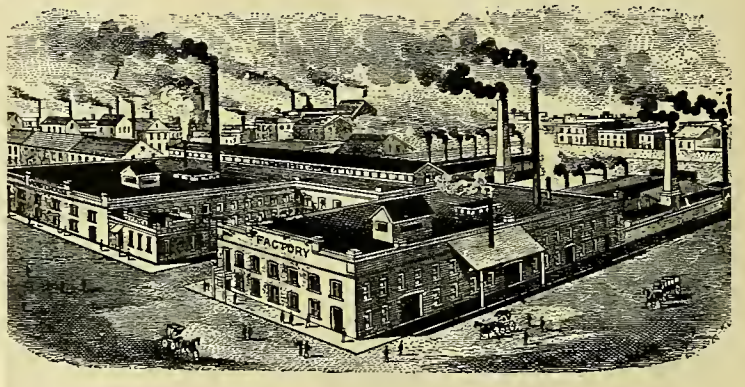
If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

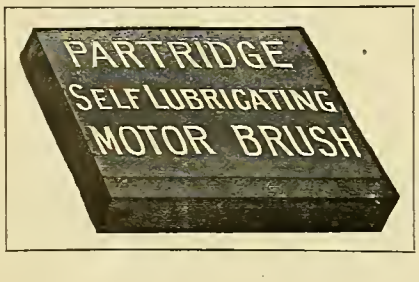
Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.



GOOD BRUSHES ARE CHEAPER THAN COMMUTATORS.

USE

"PARTRIDGE"

AND SAVE MONEY.

PARTRIDGE CARBON WORKS,

SANDUSKY, OHIO.

Wagner Transformers

TYPE F

ARE ADAPTED FOR

Central Station Use.

Efficient,
Compact,
Best Mechanical
Workmanship.

Central Electric Company,

264-270 FIFTH AVENUE, CHICAGO.

DEKONITE
IT NEVER DISAPPOINTS

Federal Batteries

Using... **Federal Salt**

ARE STRONGER THAN ANY

Salammoniac Cell...In the World.

Initial Voltage 1.6 to 1.8.

FEDERAL SALT

USED IN

Carbon Cylinder Batteries

GIVES

33% MORE E. M. F.
AND 33% LONGER LIFE
THAN SALAMMONIAC.

Absolutely no crystalizing Salts.

ESPECIALLY ADAPTED

TELEPHONES, HOUSE BELLS,
RAILROAD SIGNALS AND ALL
HARD OPEN-CIRCUIT WORK.

MADE BY

FEDERAL BATTERY COMPANY,

11 PINE STREET,

ALL DEALERS. NEW YORK.

CATALOGUE No. 11 NOW READY, 352 PAGES.

MANHATTAN ELECTRICAL SUPPLY CO.

32 Cortlandt Street, NEW YORK.

1,000,000 sold during the past twelve months.

Mesco Dry Battery.

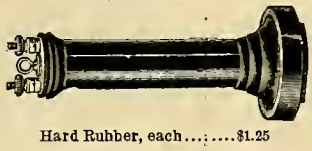
Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2¼x6½

We make all sizes.

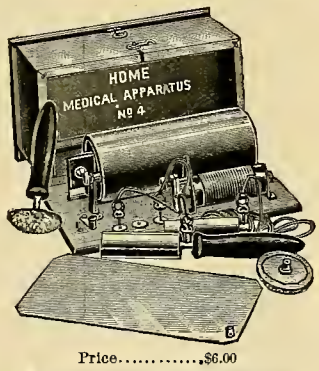
Telephone Receivers.



Hard Rubber, each.....$1.25

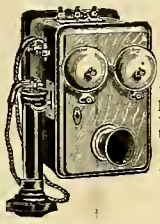
Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....$6.00

We make a number of different styles.



Telephone Outfit, No. 14,

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

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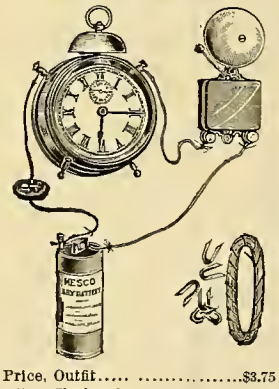
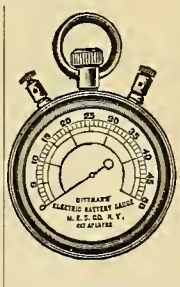


Price, Outfit.....$3.75
" Clock only..... 2 25

Pony Telephone Receiver.

Retail price, 90 cents.



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Price.....$9.00

We make a dozen different Telephone Outfits.

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OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

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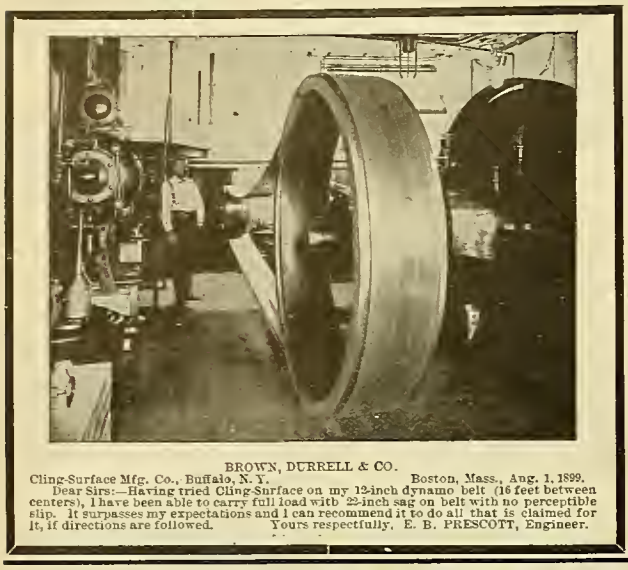

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MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say.
Write Us.

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177-182 VIRGINIA ST., BUFFALO, N. Y.

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Munsell & Co., Eugene.

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Bullock Elec. Mfg. Co.
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Bullock Elec. Mfg. Co.
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Chicago Rheostat Co.
Clark, Jas. Jr., & Co.
Eagle Electric Works.
Ft. Wayne Elec. Wks, Inc.
General Electric Co.
General Inc. Arc Light Co.
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Besly & Co. Chas. H.
Robertson & Sons, Jas. L.

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Cling-Surface Mfg. Co.
Eagle Paint & Varnish Wks.
Mass. Chemical Co.
Standard Paint Co.

Patent Attorneys.
Hamlin, Geo. R.
Johnston, Thomas J.

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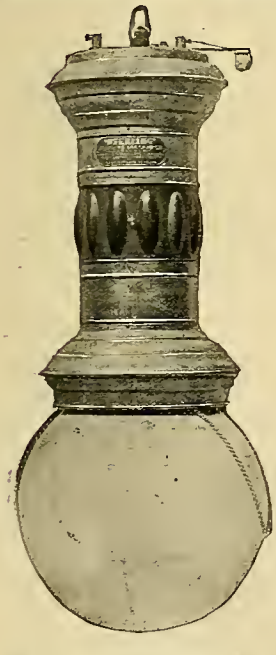

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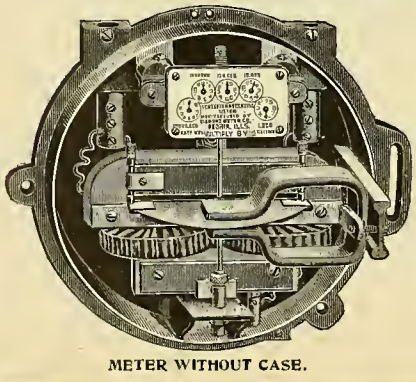

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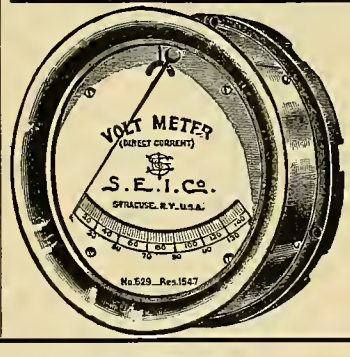

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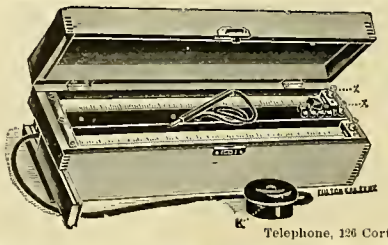

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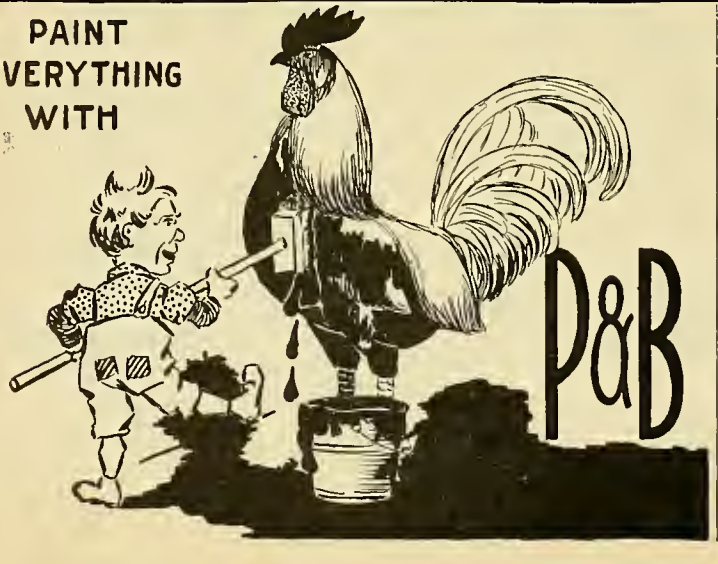

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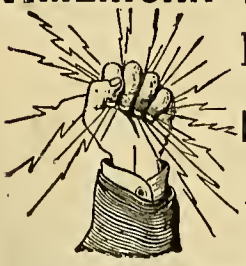

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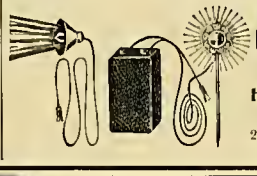

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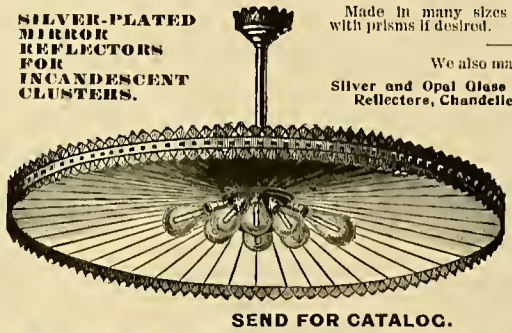

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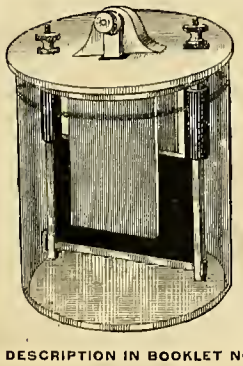

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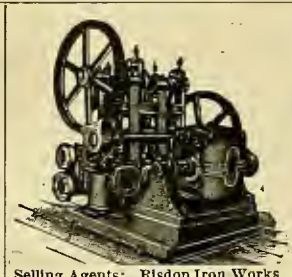

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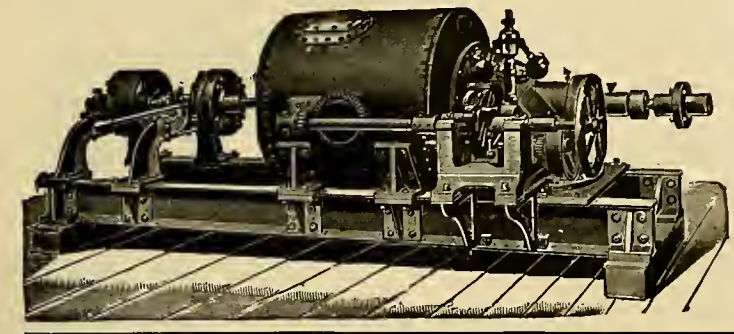

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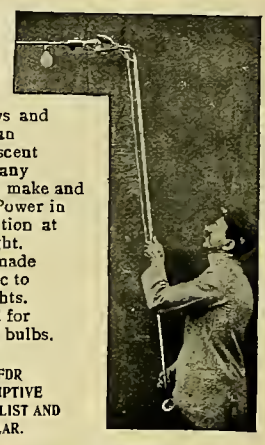

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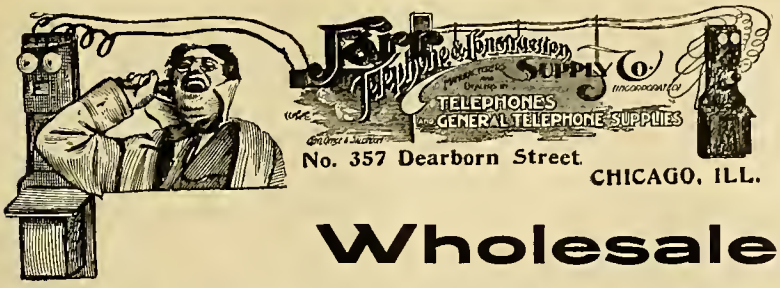

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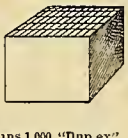

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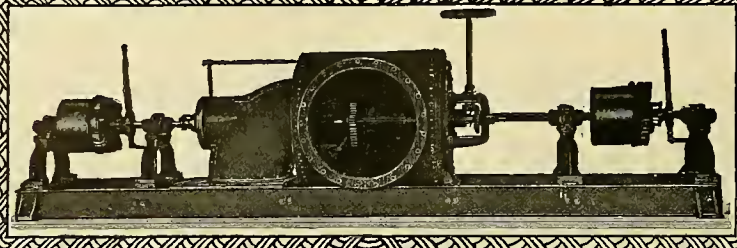

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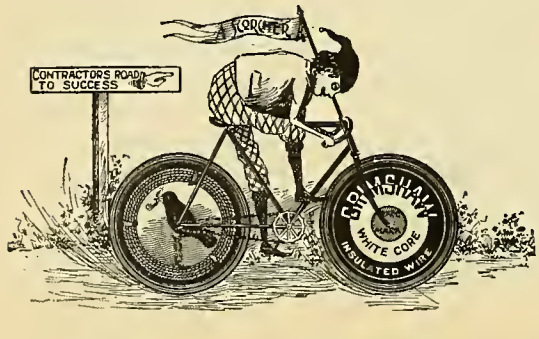

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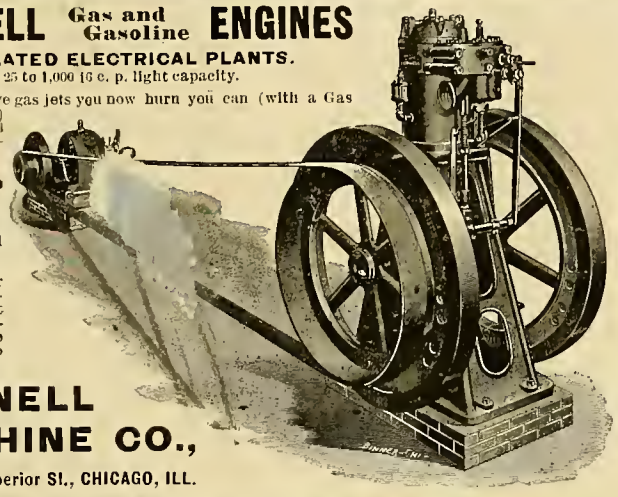

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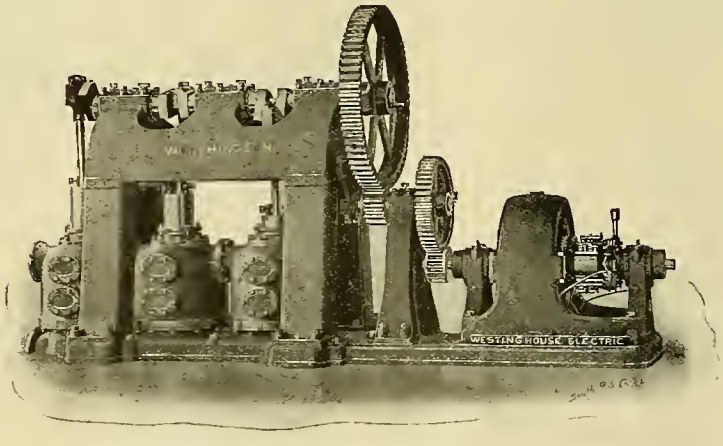

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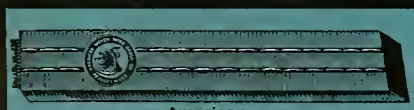

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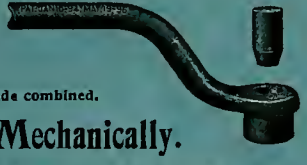
MORE "Crown" Rail Bonds



Are in use than all other styles of Rail Bonds combined.

Perfect—Electrically and Mechanically.

VARIETY OF SHAPES TO MEET ALL REQUIREMENTS OF RAIL BONDING.

WASHBURN & MOEN Dept.,

American Steel & Wire Co.,

The Rookery, CHICAGO, ILL.

STANDARD

Standard Underground Cable Co.

542 The Rookery, Chicago. Westinghouse Bldg., Pittsburg. 507 Security Building, St. Louis, Mo. 18 Cortlandt St., New York City. 1225 Betz Bldg., Philadelphia, Pa.

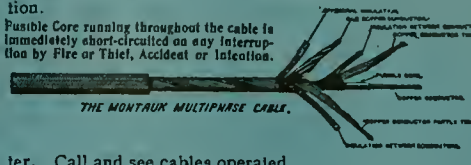
Electric Cables, Conduits, Wires and Accessories.

Also High Grade Rubber Covered Wires and Cables.

The Only Fire Detective Cable in the World.

Every Fractional Part of which is continuously Thermostatic, and designed for all Interior Electric Wiring Adaptations. It lights the gas! Rings the door bell! It automatically notifies of fire and indicates that burglars are at work, all in one installation.

Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, Accident or Infection.



THE MONTAUK MULTIPHASE CABLE.

Why use dormant wires? The Montauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human being is to the touch of flame.

Write for descriptive matter. Call and see cables operated.

MONTAUK MULTIPHASE CABLE CO.,

Telephone 4031 Cortlandt. 100 Broadway, NEW YORK.

2,000 IN USE.

Bipolar and Multipolar Motors from ½ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

Queen & Co.,

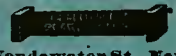
1012 Chestnut St., PHILADELPHIA.

Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils

INSULATE ARMATURES WITH PAINT OR VARNISH ACCORDING TO CHEMICAL LAW INSTEAD OF BY HABIT. NOWHERE ARE EXPERIMENTS OR ARCHAIC METHODS SO WASTEFUL MASSACHUSETTS CHEMICAL CO. BOSTON U.S.A.

C. F. SPLITDORF,

X-Ray Coils, Telephone Coils.



Medical Coils, Spark Coils.

17-27 Vandewater St., New York.

Chicago Belting Company

MAKERS OF LEATHER BELTING — RELIANCE — DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

The production of our Dynamo brand of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and in all climates.

When ordering Dynamo Belting always state the system used.

67-69 SOUTH CANAL STREET CHICAGO, ILL.

NEW ORLEANS ST. LOUIS MEMPHIS

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.

WALSH'S SONS & CO., NEWARK, N. J.

WANTED FOR CASH.

We pay $15.50 per Ounce For Scrap.

PLATINUM SHEET AND WIRE FOR SALE.

PLATINUM

GOLDSMITH BROS.,

63 and 65 Washington St., CHICAGO,

Works, 58th and Throop Sts.,

REFINERS and ASSAYERS.

Highest prices paid for old Incandescent Lamp Bases.

TIPLESS LAMPS THE SHELBY ELECTRIC CO. SHELBY, OHIO.

WESTON Electrical Instrument Co.,

114-120 William St., NEWARK, N. J., U. S. A.

Illuminated Dial Station Instruments.

These instruments are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed, dust-proof cast-iron case which effectively shields the instruments from disturbing influences of external magnetic fields.

Weston Standard

Portable Direct Reading Voltmeters and Millivoltmeters. Ammeters and Milammeters, Wattmeters and Voltmeters, for Alternating and Direct Current Circuits.

Our portable instruments are recognized as standards throughout the civilized world.

Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.

They are the most reliable, absolute standards for Laboratory use.

Nail Heads.

Get our Prices on this and other Specialties.

CLAY ELECTRIC & MFG. CO.,

210 Illinois St., CHICAGO.

GENUINE ERICSSON SWEDISH COAL-GRAIN

THE PERFECT TRANSMITTER NO PACKING. NO

I-T-E CIRCUIT BREAKERS

CUTTER ELECTRICAL CO., PHILADELPHIA

THE PHOENIX GLASS CO.

MANUFACTURERS OF

GAS AND ELECTRIC GLOBES, SHADES, Etc.

HAVE YOU A COPY OF OUR No. 8 CATALOGUE? IF NOT, SEND FOR IT.

"Midget"

ENCLOSED ARC LAMP

For Constant-Current Circuits.

The Simplest and Most Efficient for STREET AND COMMERCIAL LIGHTING.

Economy, 97.3 per cent.

Life, 125 to 150 hours with one 12 in. x $\frac{1}{2}$ in. carbon. No adjustment required for variations in amperes from $3\frac{1}{2}$ to 7 amperes. At 5 amperes equal to 1,200 candle power open arc lamp. At 6.8 amperes equal to 2,000 candle power open arc lamp. Light is white, steady, no noise, flashing or sparking. The cut shows the mechanism and the compact positive Hanger Cut-Out.

For indoor service the single globe is desirable. For outdoor use the double globe, either with or without a metal reflector above the outer globe.

No. 330.

FULL PARTICULARS, CIRCULARS AND PRICES FURNISHED ON APPLICATION.

STANDARD THERMOMETER AND ELECTRIC CO.,

PEABODY, MASS., U. S. A.

The Best Testimony is a Duplicate Order.

THE UNION TRACTION CO. OF PHILADELPHIA INSTALLED ITS FIRST BATTERY OF

CHLORIDE ACCUMULATORS

IN JULY, 1896, AND HAS RECENTLY CONTRACTED FOR FOUR ADDITIONAL BATTERY PLANTS.

THE ELECTRIC STORAGE BATTERY CO., PHILADELPHIA, PA.

SALES OFFICES:

New York, 100 Broadway. Boston, 60 State St. Baltimore, Equitable Building. Chicago, Marquette Building. San Francisco, The Parrott Building.

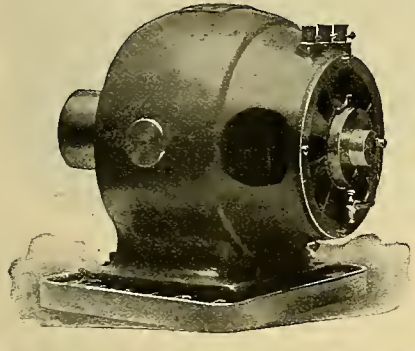
EAGLE INSULATING VARNISH.

Best made, light colored, remains elastic. Send for sample and be convinced.

Eagle Paint & Varnish Works, PITTSBURG, PA.

This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. Guarantees Satisfaction

PHILADELPHIA. H. T. PAISTE CO. CHICAGO.



"Willey" Multipolar DYNAMOS AND MOTORS.

SEMI-ENCLOSED TYPE, FOR DIRECT CONNECTION.

Manufactured by

JAMES CLARK, JR., & CO., 313 West Main St., Louisville, Ky.

Correspondence solicited.

25% DIVIDEND.

The rebate we allow on burned-out lamps when either New or Renewed lamps are ordered from us is a 25 per cent. dividend to you.

If you want this dividend write us and we will tell you how to get it.

LYNN INCANDESCENT LAMP CO., LYNN, MASS.

INCANDESCENT LAMPS

THAT MAINTAIN THEIR CANDLE POWER AND PRODUCE A PURE WHITE LIGHT, BECAUSE THEY HAVE A PERFECT

VACUUM

Made of the Highest Grade Materials, and by latest process known. Quality Guaranteed.

Prices F. O. B., Owensboro, Ky, 8, 10, 16 C. P., Bbl. Lots, 17c. each. 32 C. P., Bbl. Lots, 25c. each. Either E., T. H. or W. H. Bases.

TRY A BARREL AND BE CONVINCED.

MANUFACTURED BY

KENTUCKY ELECTRICAL CO., INCORPORATED, OWENSBORO, KENTUCKY.

THE REAL THING!

PAILLARD NON-MAGNETIC WATCHES

ENDORSED BY THE GREATEST ELECTRICIANS AND SCIENTISTS OF THE WORLD.

A USEFUL GIFT!

NO MORE USEFUL OR WELCOME GIFT COULD BE DESIRED. IT'S A GOOD THING TO HAVE YOURSELF.

FOR DESCRIPTIVE CIRCULAR WRITE

A. C. BECKEN

103 STATE ST. CHICAGO.

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FOREIGN AND DOMESTIC

CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

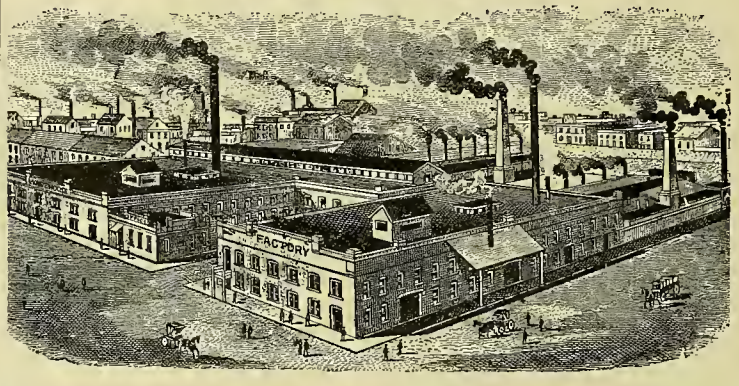
If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

THE D. & W. FUSE CO.

MANUFACTURE

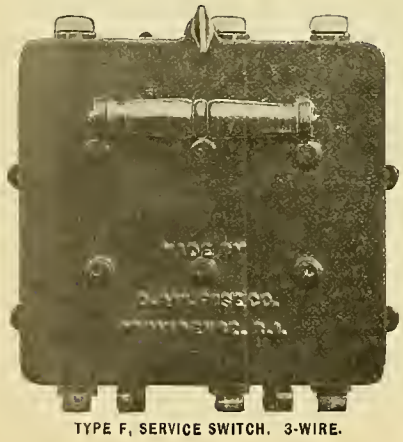
SERVICE SWITCHES

FOR TWO AND THREE WIRE SYSTEMS.

May be used on outside of buildings and in wet cellars, as they are water-tight.

FITTED WITH D. & W. FUSES.

D. & W. FUSE CO., Providence, R. I.



TYPE F, SERVICE SWITCH. 3-WIRE.

TYPE D, SERVICE SWITCH. 2-WIRE

Telephone

Construction and Wiring

SUPPLIES

IN OUR

CHICAGO STOCK

And fully covered by
PRICE LISTS Nos. 372 AND 373.
Send for these.

Central Electric Company,

264-270 FIFTH AVENUE, CHICAGO.

OKONITE
IT NEVER DISAPPOINTS

Federal Batteries

Using... Federal Salt

ARE STRONGER THAN ANY

Salammoniac Cell... In the World.

Initial Voltage 1.6 to 1.8.

FEDERAL SALT

USED IN

Carbon Cylinder Batteries

GIVES

33% MORE E. M. F.
AND 33% LONGER LIFE
THAN SALAMMONIAC.

Absolutely no crystalizing Salts.

ESPECIALLY ADAPTED

TELEPHONES, HOUSE BELLS,
RAILROAD SIGNALS AND ALL
HARD OPEN-CIRCUIT WORK.

MADE BY

FEDERAL BATTERY COMPANY,

11 PINE STREET,

ALL DEALERS. NEW YORK.

CATALOGUE No. 11 NOW READY, 352 PAGES.

MANHATTAN ELECTRICAL SUPPLY CO.

32 Cortlandt Street, NEW YORK.

1,000,000 sold during the past twelve months.

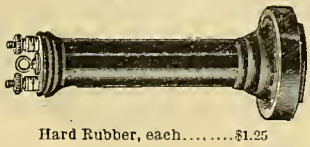
Mesco Dry Battery.

Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2½x6½
We make all sizes.

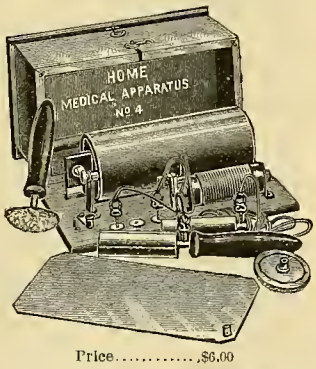
Telephone Receivers.



Hard Rubber, each.....$1.25

Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....$6.00
We make a number of different styles.

Telephone Outfit, No. 14.

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

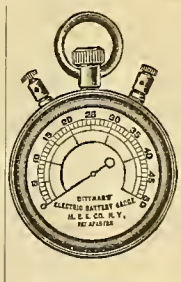
Price, with two cells Mesco Dry Battery, $9.00.

Alarm Clock Outfit, No. 1½.

Price, Outfit $3.75
" Clock only..... 2 25

Pony Telephone Receiver.

Retail price, 90 cents.



Dittmar Pocket Battery Gauge.

Will register the strength of open or closed circuit batteries.

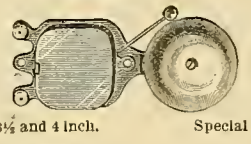
Price each, $3.50.

Desk Telephone Outfit, No. 11.

Price.....$9.00

We make a dozen different Telephone Outfits.

Iron Box Bells, No. 97.



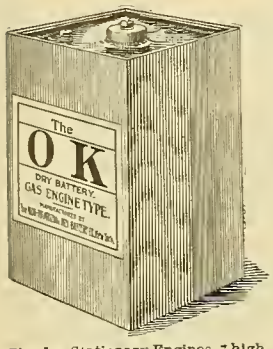
2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.

OK DRY BATTERY,

NEW GAS ENGINE TYPE.



Size for Stationary Engines, 7 high by 4¼ square.
Size for Automobiles, 7 high by 4 square.

THE PROBLEM SOLVED.

No Solution to slop over. No Missing of sparks.
Highest Voltage.
Quickest Recuperation. Long Life.
Unaffected by heat or cold. Compactness.

BOXED, CONNECTED, COMPLETE, READY TO BE HITCHED TO ENGINE.

POINTS IN ORDERING.

1. Name of engine.
2. Number of revolutions per minute.
3. Number of sparks per minute.
4. Mode of ignition, whether by spark coil or induction coil.
5. If spark coil, whether butting or wiping spark.
6. Kind of spark contact points, whether platinum, steel or other material.
7. Average number of hours per day engine is run.

NON-POLARIZING DRY BATTERY CO., 625 BROADWAY, NEW YORK.

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Annunciators.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co
Western Elec. Supply Co.

Arc Lamps.
Belden-Larwill El. & Mf. Co.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Lea Manufacturing Co.
Standard Therm. & El. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Batteries and Jars.
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Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Federal Battery Co.
Gordon Battery Co.
Leclanche Battery Co., The
Manhattan Elec. Supply Co.
National Carbon Co.
Non-Polarizing Dry Bat. Co.
Ohio Electric Works.
Peru Elec. Mfg. Co.
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Ohio Electric Works.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
Chicago Belting Co.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Books, Electrical.
Electrician Publishing Co.

Brushes.
Amer. Wov. Wire Brush Co.
Central Electric Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Partridge Carbon Wks.
Western Elect. Supply Co.

Brush Holders.
Clay Electric & Mfg. Co.

Burglar Alarms.
Central Electric Co.
Electric Appliance Co.
Huehel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Eastern Electric Cable Co.
General Electric Co.
Manhattan Elec. Supply Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Gen'l Inc. Arc Lt. Co.
Manhattan Elec. Supply Co.
National Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Speer Carbon Co.
Western Elect. Supply Co.

Chemists.
Harvey Co., The G. F.

Clutches (Arc Lamp).
Peterson & Co., John L.

Coils and Magnets.
Splitdorf, C. F.
Varley Duplex Magnet Co.

Compound.
Dearborn Drug & Chem. Wks
Mass. Chemical Co.
McLennan & Co., K.
Standard Paint Co.
Trotter's Mona Mfg. Co., Ld.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Central Electric Co.
Electric Appliance Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
McIntire Co., The C.

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Chicago Edison Co.
Clark, Jas. Jr., & Co.
Ft. Wayne Elec. Wks., Inc.
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Hodge-Walsh Elec. Eng. Co.
Northern Elec. Mfg. Co.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Arnold El. Power Station Co.
Bain, Foree.
Bryan & Humphrey.
Bullock Elec. Mfg. Co.
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Clark, Jas. Jr., & Co.
Cornell Machine Co.
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General Electric Co.
Hays Construction Co.
Northern Elec. Mfg. Co.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse Elec & Mfg Co.

Copper.
Besly & Co., Chas. H.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Besly & Co., Chas H.
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Chicago Edison Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec. Supply Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons. Co., J. A.
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Int. Correspond. Schools.
United Corresp. Schools.

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Foote, Pierson & Co.
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General Elec. Co.
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Meyrowitz, E. B.
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Schiff, Jordan & Co.
Wagner Elec. Mfg. Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Dynamos.
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General Inc. Arc Light Co.
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Wagner Elec. Mfg. Co.
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Manhattan Elec. Supply Co.
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Paiste Co., H. T.
Queen & Co.
Rolfe Electric Co.
Schiff, Jordan & Co.
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Western Electric Co.
Western Elect. Supply Co.
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Columbia Elec. & Mfg. Co.
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Plass, E. H., Electric Co.
Pringle, Wm. T.
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Ball Engine Co.
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Western Elect. Supply Co.

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Chicago Insulated Wire Co.
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Paiste Co., H. T.
Pern Elec. Mfg. Co.
Phillips Insulated Wire Co.
Schiff, Jordan & Co.
Simplex Electrical Co.
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Standard Underground C. Co.
Sterling Varnish Co.
Steward Mfg. Co., D. M.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Chicago Insulated Wire Co.
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Electric Appliance Co.
General Electric Co.
Manhattan Elec. Supply Co.
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National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Electric Appliance Co.
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Robertson & Sons, Jas. L.
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General Inc. Arc Light Co.

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Ft. Wayne Elec. Wks, Inc.
General Electric Co.
General Inc. Arc Light Co.
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Kendrick & Davis.
Manhattan Elec. Supply Co.
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Thompson, Son & Co.
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Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Johnston, Thomas J.

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Perrizo & Sons.
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Western Electric Co.
Western Elect. Supply Co.

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Queen & Co.
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Barnes Co, The Wallace.
Cary Spring Works.

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Electric Storage Battery Co.

Tapes, Insulating.
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Electric Appliance Co.
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Okonite Co., The.
Simplex Electrical Co.
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Columbia Elec. & Mfg. Co.
Couch & Seeley Co.
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Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
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Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
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Murdock & Co., W. J.
Noblett, E. J.
North Electric Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tl. M. Co.
Warner Co, W. F., The.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Cons. Co.
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Toys, Electrical.
Kendrick & Davis.
Ohio Electric Works
Plass, E. H., Electric Co.

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Thompson, Son & Co.
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Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Elect. Supply Co.

Woodwork, Electrical.
Noblett, E. J.

X Ray Outfits.
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Queen & Co.
Splitdorf, C. F.

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50-Light Constant Current Transformer, Complete.

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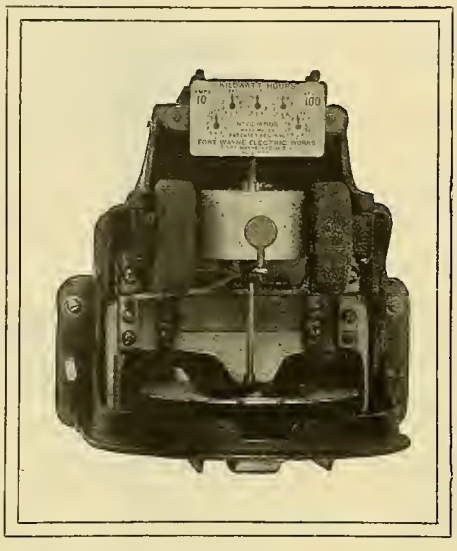

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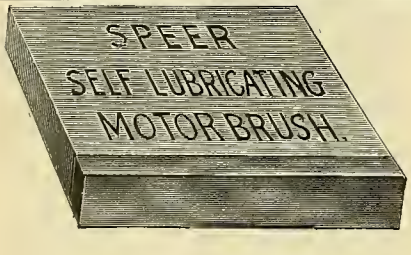

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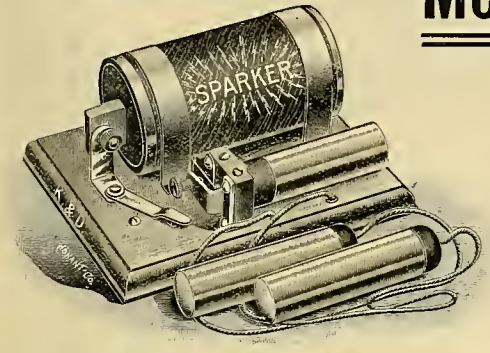

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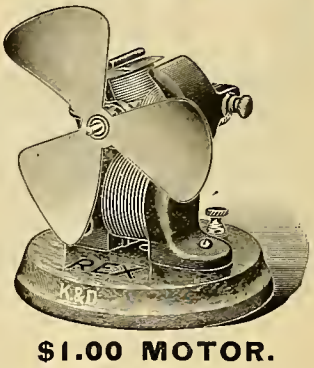

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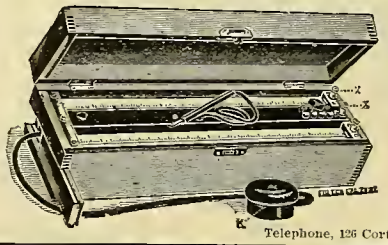

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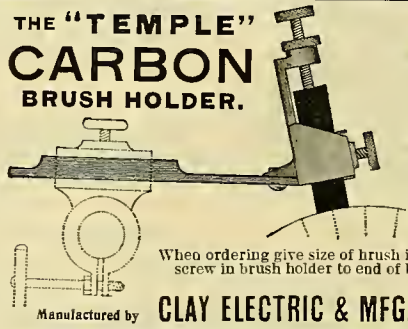

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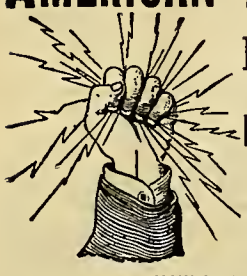

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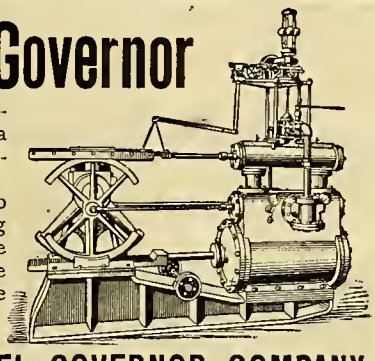

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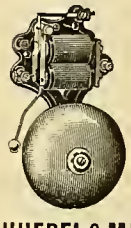

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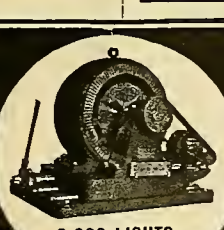

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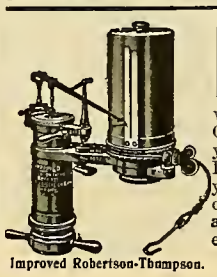

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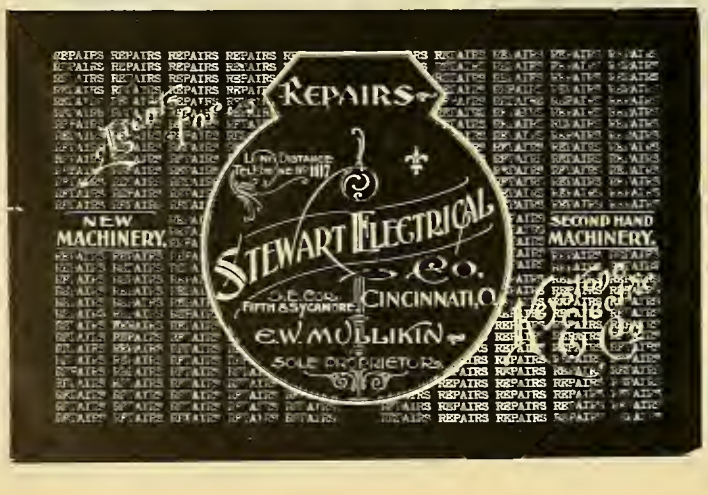

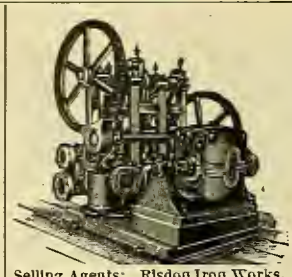

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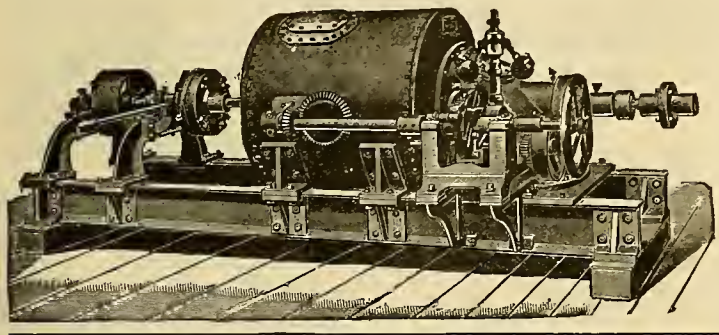

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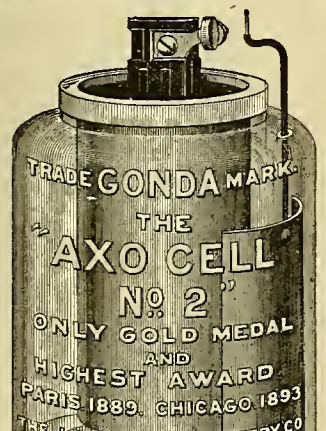

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WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 300 ampere hours; for No. 2 cell, 125 ampere hours; on open circuit, .9 to 1 volt; on closed circuit, .65 to .75 volt. Send for circular and price list.

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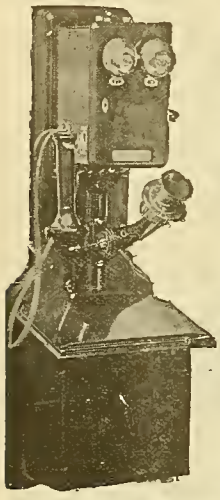

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No order too small for attention or too large for our capacity. Rapid deliveries our rule, and each order filled with care. Large stocks always on hand.

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A trial will convince anyone of their superiority on either short or long distance work.

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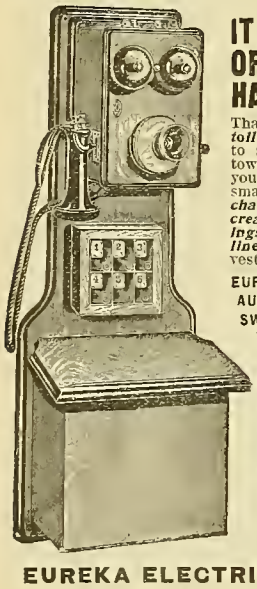

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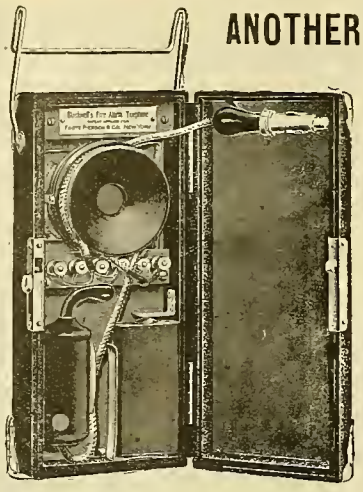

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FOR ALL PURPOSES

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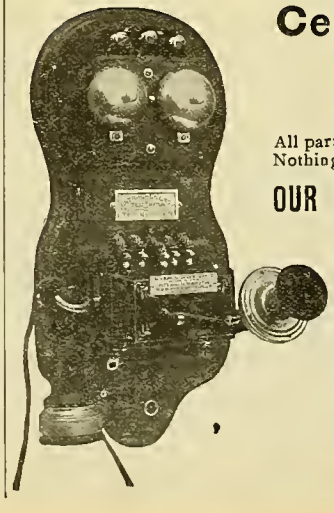

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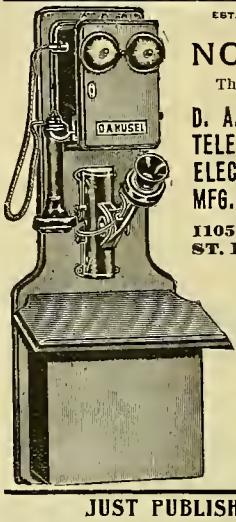

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IN our efforts to secure your business we have often longed for that gift of prophecy which seems so easily acquired by many of our Telephone friends, that we might be able to give you the exact dates when all competitors would be wiped off from the face of the earth. Failing in this accomplishment, we have sighed for that spirit of poetry which would enable us to melt your icy heart and cause you to sweat blood as a penalty for not using the W. & C. Bi-polar Receiver and our complete Telephone Equipment. But we have no such ability. Our only salvation seems to be in making the best telephone apparatus on earth, and some day you will find it out.

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This instrument, for volume of voice transmission, distinctness of articulation, exact reproduction of articulate sounds and durable qualities is unequaled

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Seven hundred exchanges aggregating over 300,000 telephones in use. Six years' service.

Write for catalogue showing new types and prices.

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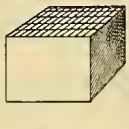
HERE'S THE OBJECT LESSON— A PLAIN FACT



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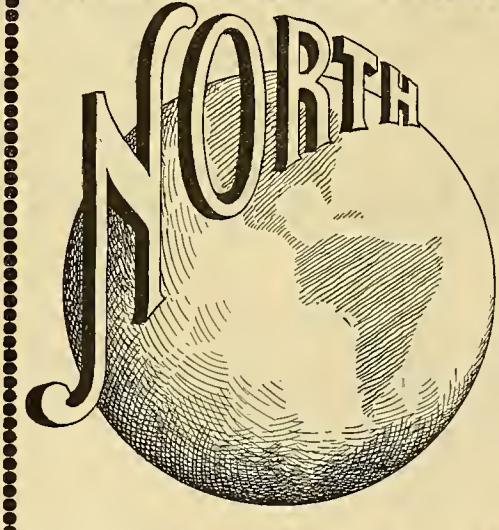

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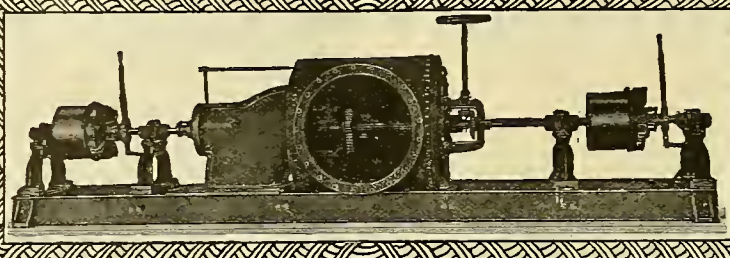

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Our Telephones are working successfully where others have failed,
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Write for new catalogue just out, showing full line of Telephones, Switchboards, Lightning Arresters. Everything for the full equipment of an Exchange.

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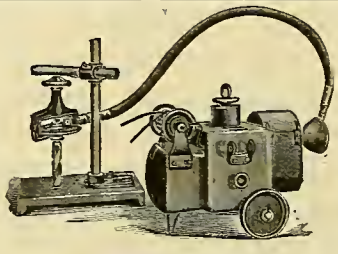

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MULTI-SPEED MOTOR.
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Trotter's Mona Commutator Compound is the most efficient lubricator, the only article that is guaranteed to stop sparking. It is used in the largest electric power plants throughout the United States and Canada. It puts that beautiful luster on your commutator, lubricates the brushes, and keeps the surface in that condition that you have long sought to obtain. Does away with the use of sandpaper or any other material that wears out or destroys its surface. If you want your machine to run noiseless and sparkless, thus obtaining your equilibrium and quietness, you will certainly adopt its use.
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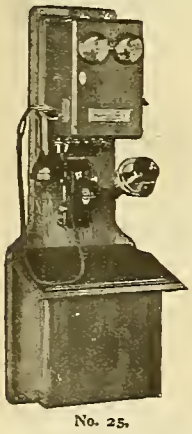

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We assure you, **you will be making a mistake,** unless you examine our No. 25 Phones before placing your large orders.
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LIGHT WEIGHT AND LIQUID TIGHT.

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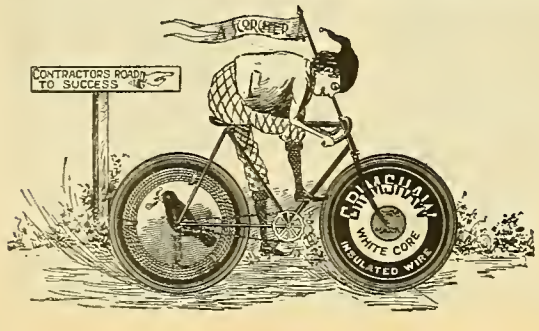

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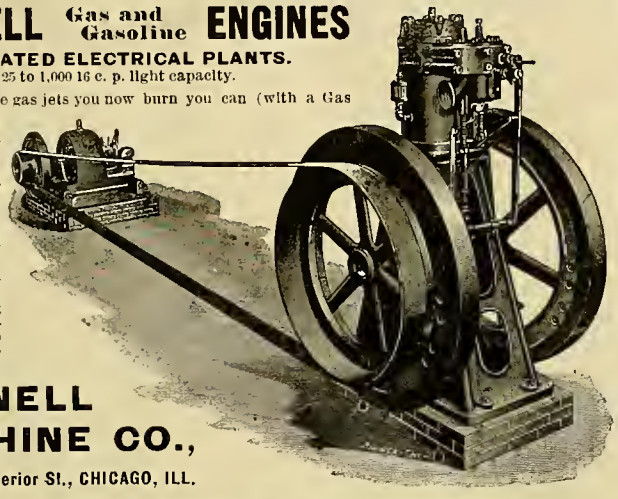
ISOLATED ELECTRICAL PLANTS.
25 to 1,000 16 c. p. light capacity.



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Also in gangs of any number up to eight.

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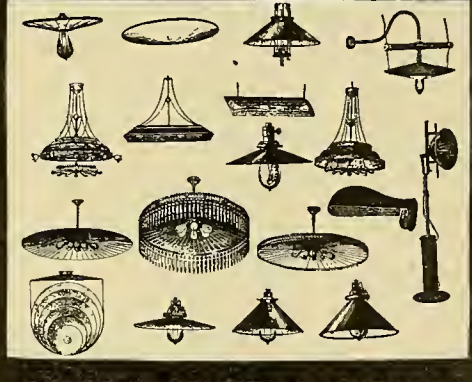

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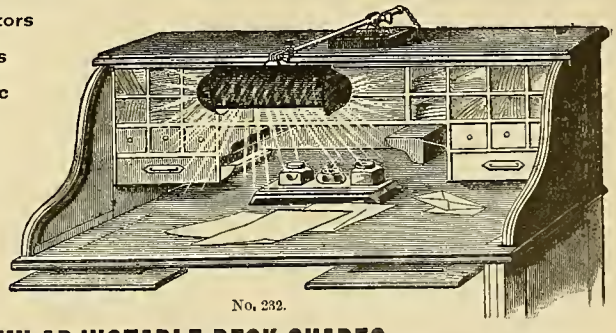

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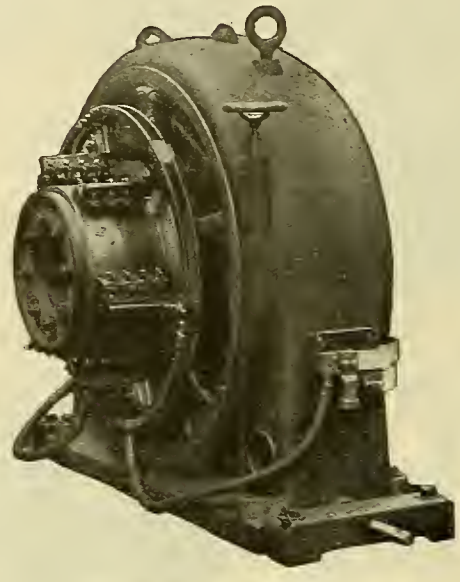

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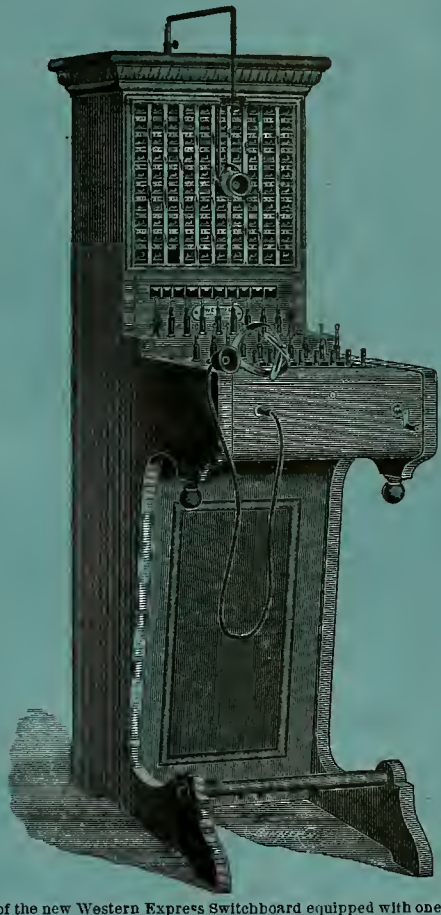

Brackets,

Insulators,

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Pole Steps,

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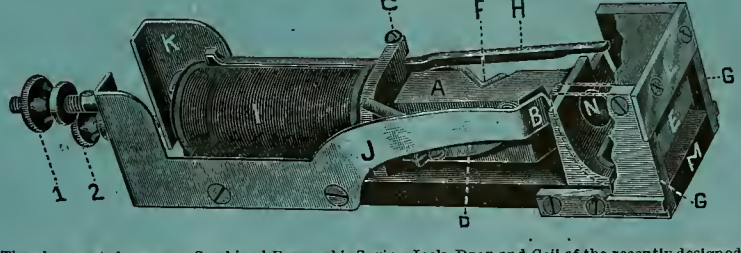
Perspective view of the new Western Express Switchboard equipped with one hundred combined removable jacks, drops and coils. This board contains many new features which, with those of the No. 1, make it a model of the designer's art.



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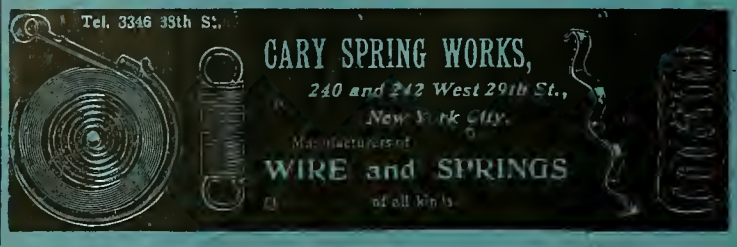

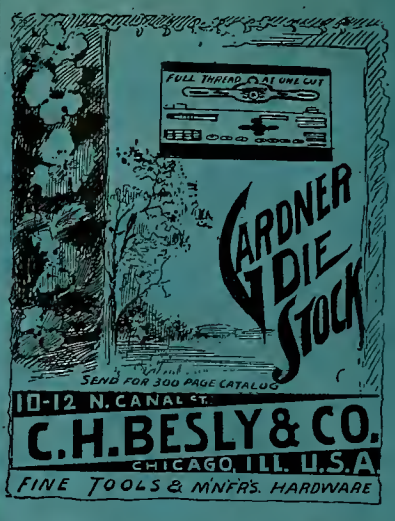

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Highest grades for electrical insulation and mechanical purposes, in sheets, tubes, rods and special shapes. Catalogues and samples on application.

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It is as easily adjusted as your window curtain. It takes the place of the fuse rosette in common use.

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—NOVELTY IN PORCELAIN—
NEW PERU FUSE PLUG.
TRY IT—YOU'LL BUY IT.
New Catalogue Out. Send for It.
PERU ELECTRIC MFG. CO., PERU, IND.

SMALL SPRINGS
OF EVERY DESCRIPTION
THE WALLACE BARNES CO.,
ESTABLISHED 1850 BRISTOL, CONN., U. S. A.

DOUBLING THE SPEED OF A FAN

increases the required power eight-fold.

DOUBLING THE SPEED OF AN ELECTRIC MOTOR

increases the output only two-fold.

HENCE, AN ELECTRIC FAN

requires a different size motor for each range of speed.

We have over 100 different sizes and types of motors and no end of fans.

We can make any combination you require.

Bulletin H illustrates a large variety. Send for it.

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New York Philadelphia Chicago London

Vitogen
FOR
Wounds
AND
Burns.

Vitogen has proved very successful for treating electrical burns. A great many electricians keep it constantly at hand, as a burn is liable to come at any time. After once trying Vitogen, you would not be without it.

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Manufacturing Chemists, THE G. F. HARVEY CO., Saratoga Springs, N. Y., U. S. A.
Canadian Branch, Mille Roches, Ont., KEZAR & BENNETT, Agents.

WESTERN ELECTRICIAN.

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Vol. XXV. CHICAGO, DECEMBER 2, 1899. No. 23

SIMPLEX INSULATED WIRES AND CABLES.

RUBBER COVERED, WEATHERPROOF, UNDERGROUND AND SUBMARINE.

WESTERN SELLING AGENT. H. R. HIXSON, 1137 Monadnock Block, CHICAGO.

Simplex Electrical Company, 75-21 Cornhill, BOSTON, MASS.

OKONITE

TRADE MARK.

1889—Paris Exposition, Medal for Rubber Insulation.

1893—World's Fair, Medal for Rubber Insulation.

THE STANDARD FOR RUBBER INSULATION.

Sole Manufacturers of

Okonite Wires, Okonite Tape, Manson Tape, Candee Weather-proof Wires.

THE OKONITE CO., LTD.

Managers. Allard L. Candee, Durant Cheever, 253 Broadway, New York. Geo. T. Manson, Gen'l Supt. W. H. Hodgins, Secy.

MORE "Crown" Rail Bonds

Are in use than all other styles of Rail Bonds combined.

Perfect—Electrically and Mechanically.

VARIETY OF SHAPES TO MEET ALL REQUIREMENTS OF RAIL BONDING.

WASHBURN & MOEN Dept.,

American Steel & Wire Co.,

The Rookery, CHICAGO, ILL.

READY FOR THE MARKET.

"PERUCO," the new style Creole rosette. Insulation perfect, long fuse, superior in every detail.

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The Only Fire Detective Cable in the World.

Every Fractional Part of which is continuously Thermostatic, and designed for all Interior Electric Wiring Adaptations. It lights the gas! Rings the door bell! It automatically notifies of fire and indicates that burglars are at work, all in one installation.

Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, Accident or Intention.

THE MONTAUK MULTIPHASE CABLE.

Why use dormant wires? The Montauk Automatic Thermostatic Electric Cables are as sensitive to heat or fire as the nervous system of a human being is to the touch of flame.

Write for descriptive matter. Call and see cables operated.

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Bipolar and Multipolar Motors from ⅛ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

Queen & Co.,

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Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils

INSULATE ARMATURES WITH PAINT OR VARNISH ACCORDING TO CHEMICAL LAW INSTEAD OF BY HABIT. NOWHERE ARE EXPERIMENTS OR ARCHAIC METHODS SO WASTEFUL MASSACHUSETTS CHEMICAL Co. BOSTON, U.S.A.

C. F. SPLITDORF,

X-Ray Coils, Telephone Coils. Medical Coils, Spark Coils.

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MAKERS OF LEATHER BELTING. RELIANCE DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

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When ordering Dynamo Belting always state the system used.

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SECOND-HAND ELECTRICAL MACHINERY.

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LAVA WASHERS. LAVA BUSHINGS. LAVA THREADED PIECES.

Combine High Heat Resistance with BEST INSULATING QUALITY.

Send drawing or model for estimate.

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Illuminated Dial Station Instruments.

These instruments are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed, dust-proof cast-iron case which effectively shields the instruments from disturbing influences of external magnetic fields.

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Portable Direct Reading Voltmeters and Millivoltmeters. Ammeters and Milammeters, Wattmeters and Voltmeters, for Alternating and Direct Current Circuits.

Our portable instruments are recognized as standards throughout the civilized world.

Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.

They are the most reliable, absolute standards for Laboratory use.

Mention the WESTERN ELECTRICIAN when writing for catalogues.

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The latest in this line is the "NEW STYLE" made by

WM. T. PRINGLE, 1026 Filbert Street, PHILADELPHIA.

Western Representatives: J. B. McKeague Co., 324 Dearborn St., Chicago.

25% DIVIDEND.

The rebate we allow on burned-out lamps when either New or Renewed lamps are ordered from us is a 25 per cent. dividend to you.

If you want this dividend write us and we will tell you how to get it.

LYNN INCANDESCENT LAMP CO., LYNN, MASS.

National India Rubber Co's RUBBER COVERED Wires and Cables.

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32 Cortlandt Street, NEW YORK.

1,000,000 sold during the past twelve months.

Mesco Dry Battery.

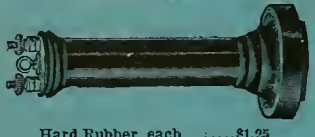
Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2¼x6½

We make all sizes.

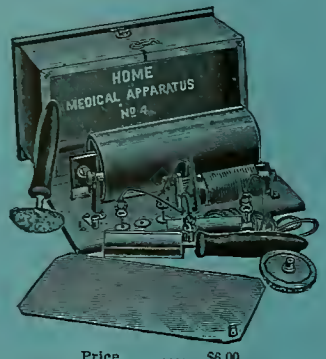
Telephone Receivers.



Hard Rubber, each.....$1.25

Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....$6.00

We make a number of different styles.

Telephone Outfit, No. 14,

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

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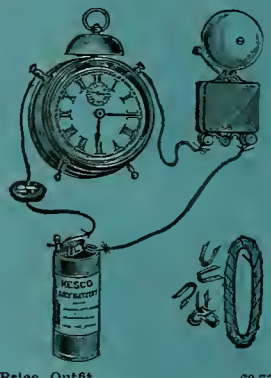

Price, Outfit.....$3.75

" Clock only..... 2.25

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Retail price, 90 cents.

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Will register the strength of open or closed circuit batteries.

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Price.....$9.00

We make a dozen different Telephone Outfits.

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2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

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G. I.

PERFECT contact between upper carbon and central tube—supplied through a novel flexible wire arrangement.

Skeleton for solenoids made of vulcabeston, reducing heating effect in coils 25 per cent.

Confinement of all vibration within U-shaped core—an almost absolutely noiseless alternating-current lamp.

Carbons 9½x½ inch upper; lower, 5¾x½ inch, one cored and one solid.

Length over all 25 inches, or with reflector 24 inches. Weight about 24 lbs.

Life 75 hours, more according to quality of carbons.

Wide range in adjustment, from 50 to 133 cycles on 95 to 125 volts.

Ready access to inner globe and trimming device.

Made for globe or reflector in any finish.

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GENERAL INCANDESCENT ARC LIGHT CO.,

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MINNEAPOLIS: 516 Guarantee Building.
MILWAUKEE: 438 Ulhlein Building.
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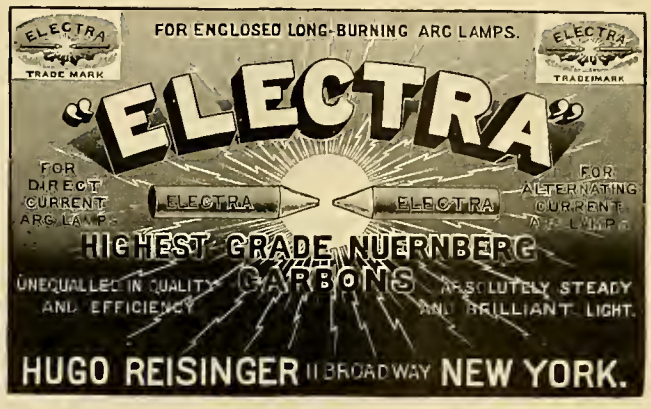
The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."



Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. Guarantees Satisfaction

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EAGLE INSULATING VARNISH. Best made, light colored, remains elastic. Send for sample and be convinced.

Eagle Paint & Varnish Works, PITTSBURG, PA.

INCANDESCENT LAMPS

That maintain their Candle Power and produce a Pure White Light, because they have

A PERFECT VACUUM.

Made of the Highest Grade Materials, and by Latest Process known. Quality Guaranteed.

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MANUFACTURED BY...

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INCANDESCENT LAMPS G. & W.

LIFE--Because they are Well Made.
EFFICIENCY--Because the filaments are the Best.
ECONOMY--Because they are Lower in Price and give better light with less consumption of current than any other lamp on the market.

SPECIAL PRICES offered to Electrical Supply Houses, Power Plants, Railways and all large users of Incandescent Lamps.

OUR LAMPS ARE OUR BEST SALESMEN. LET US SEND YOU SAMPLES.

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CHICAGO INSULATED WIRE CO. 152-154 Lake St. CHICAGO, ILL. U.S.A.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

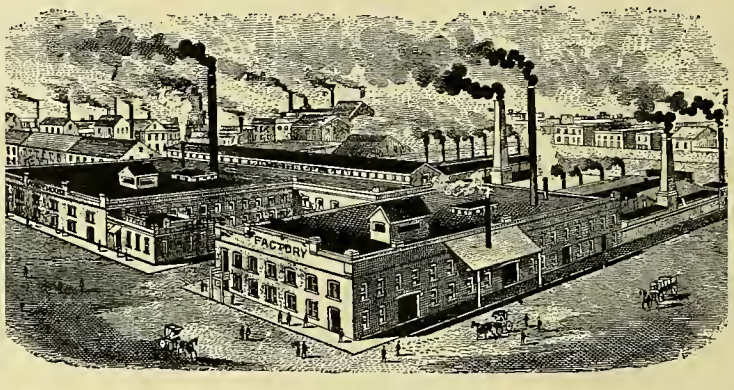
If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

THE UNITED ELECTRIC IMPROVEMENT CO.

Office and Works: 19th and Allegheny Avenue,

PHILADELPHIA, PA.

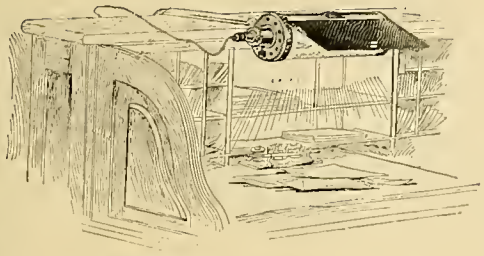
MANUFACTURERS OF

Direct and Alternating Current Apparatus for Lighting and Transmission of Power.

High-Grade Incandescent Lamps

FOR ANY SERVICE.

SEND FOR SAMPLES OF OUR NEW SERIES LAMPS.



Whether Self-Contained Current

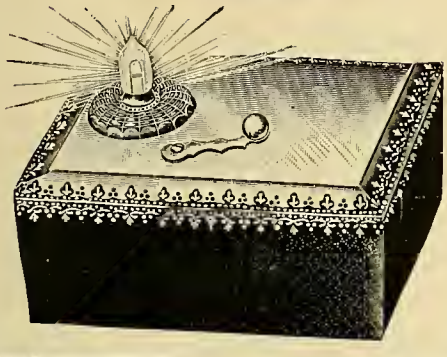
or from Commercial Circuits,

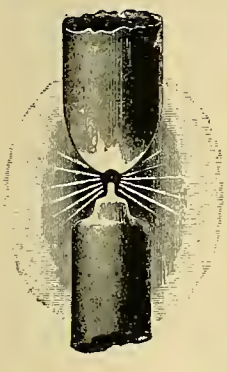
we supply all devices in

ELECTRIC LIGHTING.

Central Electric Company,

264-270 FIFTH AVENUE, CHICAGO.





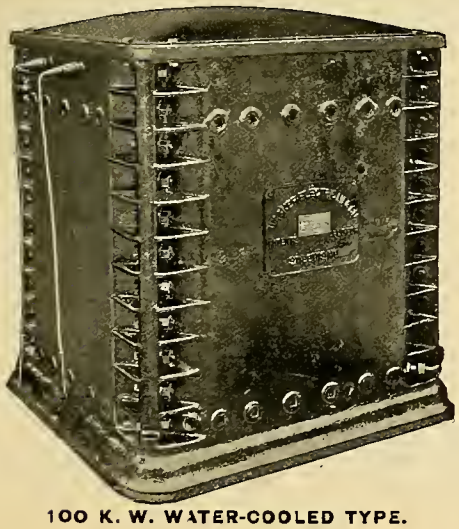
COLUMBIA CARBONS

FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

NATIONAL CARBON COMPANY,

1198 West Madison Avenue,
CLEVELAND OHIO.



100 K. W. WATER-COOLED TYPE.

When You Want TRANSFORMERS of Any Size,

Send Us Your Specifications.

We build them in units of any size required and for any ratio of voltage transmission desired in any of the following types.....

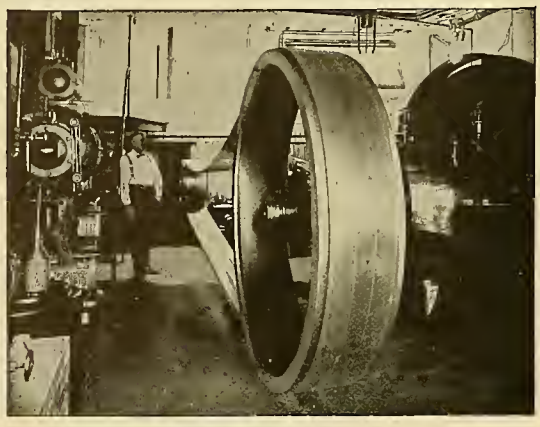
WATER-COOLED OIL-FILLED, SELF-COOLING OIL-FILLED, ...AIR-BLAST DRY.....

Send for Bulletins 9, 12 and 16, descriptive of our different types.

WAGNER ELECTRIC MFG. CO.,

GENERAL OFFICES AND FACTORY,
ST. LOUIS, U. S. A.

BRANCHES--NEW YORK, PHILADELPHIA, BOSTON CHICAGO, SAN FRANCISCO.



BROWN, DURRELL & CO.

Cling-Surface Mfg. Co., Buffalo, N. Y. Boston, Mass., Aug. 1, 1899.

Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say. Write Us.

CLING-SURFACE MFG. CO.,

177-182 VIRGINIA ST., BUFFALO, N. Y.

CHICAGO BRANCH: 225 Dearborn St.

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Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co
Western Elec. Supply Co.

Arc Lamps.
Belden-Larwill El. & Mf. Co.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Lea Manufacturing Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Batteries and Jars.
Burnley Battery & Mfg. Co.
Central Electric Co.
Edison Mfg. Co.
Electric Appliance Co.
Federal Battery Co.
Gordon Battery Co.
Leclanche Battery Co., The
Manhattan Elec. Supply Co.
National Carbon Co.
Non-Polarizing Dry Bat Co.
Ohio Electric Works.
Peru Elec. Mfg. Co.
Phoenix Battery Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Bells.
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Ohio Electric Works.
Western Electric Co.
Western Elect. Supply Co.

Belt Dressing.
Chicago Belting Co.
Cling-Surface Mfg. Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
Shultz Belting Co.

Books, Electrical.
Electrician Publishing Co.

Brushes.
Amer. Wov. Wire Brush Co.
Central Electric Co.
Bobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Western Elect. Supply Co.

Brush Holders.
Clay Electric & Mfg. Co.

Burglar Alarms.
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Manhattan Elec. Supply Co.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
Chicago Insulated Wire Co.
Eastern Electric Cable Co
General Electric Co.
Manhattan Elec. Supply Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Gen'l Inc. Arc Lt Co.
Manhattan Elec Supply Co.
National Carbon Co.
Reisinger, Hugo
Schiff, Jordan & Co.
Speer Carbon Co.
Western Elect. Supply Co.

Chemists.
Harvey Co., The G. F.

Clutches (Arc Lamp).
Peterson & Co., John L.

Coils and Magnets.
Splitdorf, C. F.
Varley Duplex Magnet Co.

Compound.
Dearborn Drug&Chem. Wks
Mass. Chemical Co.
McLennan & Co., K.
Standard Paint Co.
Trotter's Mona Mfg Co., Ld.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Central Electric Co.
Electric Appliance Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
McIntire Co., The C.

Construction & Repairs.
Bullock Elec. Mfg. Co.
Chicago Edison Co.
Clark, Jas. Jr., & Co.
Ft. Wayne Elec. Wks., Inc.
Hays Construction Co.
Hodge-Walsh Elec. Eng. Co.
Northern Elec. Mfg. Co.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Contractors and Electric Light Plants.
Arnold El. Power Station Co.
Bain, Foree.
Bryan & Bumphrey.
Bullock Elec. Mfg. Co.
Central Electric Co.
Clark, Jas. Jr, & Co.
Cornell Machine Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Hays Construction Co.
Northern Elec. Mfg. Co.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse Elec & Mfg Co.

Copper.
Besly & Co.. Chas. H.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Besly & Co., Chas H.
Central Electric Co.
Chicago Edison Co.
Chicago Insulated Wire Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec. Supply Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons. Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Correspondence Schools.
Elec. Engineer Corr. Inst.
Int Correspond. Schools.
United Corresp. Schools.

Cross-Arms, Pins and Brackets.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Electric Appliance Co.
Kas. City & So. Lumber Co.
Manhattan Elec. Supply Co.
Naugle, Holcomb & Co.
Texas Arm & Pin Co.
Valentine-Clark Co., The.
Western Elect. Supply Co.

Cut-Outs and Switches.
Hossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Chicago House Wrecking Co.
Clark, Jas. Jr., & Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Foote, Pierson & Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Hart & Hegeman Mfg Co.
Manhattan Elec. Supply Co.
Meyrowitz, E. B.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Rolfe Electric Co.
Schiff, Jordan & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg.Co.

Dynamos.
Baux, F. A.
Bullock Elec. Mfg. Co.
Central Electric Co
Clark, Jas. Jr., & Co.
Eagle Electric Works.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Hobart Elec. Mfg Co
Northern Elec. Mfg. Co.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Electric Railways.
Arnold El. Power Station Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electric Vehicles.
Woods Motor Vehicle Co.

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Arnold E.. Power Station Co.
Bain, Foree.
Bryan & Humphrey.
Bullock Elec. Mfg. Co.
Hays Construction Co.
Hodge-Walsh Elec. Eng. Co.
Northern Elec. Mfg. Co.
Sargent & Lundy.

Electrical Instruments.
American El. Specialty Co.
Central Electric Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
Foote, Pierson & Co.
General Electric Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
Ohio Electric Works.
Paiste Co., H. T.
Queen & Co.
Rolfe Electric Co.
Schiff, Jordan & Co.
S. E. I. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg.Co.
Weston Electrical Inst. Co.

Electrical Specialties.
American El. Specialty Co.
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Clay Electric & Mfg. Co.
Columbia Elec. & Mfg. Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
McIntire Co., The C.
Ohio Electric Works.
Plass, E. H., Electric Co.
Pringle, Wm. T.
Spies & Company.
Western Elect. Supply Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.

Engines, Gas.
Cornell Machine Co.

Engines, Steam.
Ball Engine Co.
Sturtevant Co., B. F.

Fan Outfits.
Central Electric Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
General Inc. Arc Light Co.
Manhattan Elec. Supply Co.
Ohio Electric Works.
Paragon Fan Motor Co.
Schiff, Jordan & Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fixtures, El. & Comb'n.
Central Electric Co.
Western Elect. Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses.
McIntire Co., The C.
Rolfe Electric Co.

Fuse Wire.
Central Electric Co.
Chicago Fuse Wire & Mf. Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
McIntire Co., The C.
Western Elect. Supply Co.

Gas Lighting, Electric.
Advance Specialty Co.
Central Electric Co.
Western Electric Co.

Gears.
Besly & Co., Chas H.

General Elec. Supplies.
Central Electric Co.
Chicago Edison Co.
Chicago House Wrecking Co.
Electric Appliance Co.
Foote, Pierson & Co
General Electric Co.
Manhattan Elec. Supply Co.
Ohio Electric Works.
Peru Elec. Mfg. Co.
Schiff, Jordan & Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Central Electric Co.
Phoenix Glass Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Guards, Wire.
Ingils, Wm, W. & Fr. Wks.

Heaters (Feed Water).
Kelley & Son, Benj F.

Holders, Inc. Lamp.
Electrolier Co., The
Faries Manufacturing Co.

Insulators and Insulating Materials.
Central Electric Co.
Chicago Edison Co.
Chicago House Wrecking Co.
Chicago Insulated Wire Co.
Eagle Paint & Varnish Wks.
Electric Appliance Co.
Emerson El. Mfg. Co.
Foote, Pierson & Co.
General Inc. Arc Light Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Schiff, Jordan & Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Sterling Varnish Co.
Steward Mfg. Co., D. M.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Chicago House Wrecking Co.
Chicago Insulated Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec. Supply Co.
Montauk Multiph. Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elec. Const. Co.
General Inc Arc Light Co.

Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fort Wayne Lamp Co.
General Electric Co.,
General Inc. Arc Light Co.
Goodchild & Welsh.
Kentucky Electrical Co.
Lynn Inc. Lamp Co.
Manhattan Elec. Supply Co.
Ohio Electric Works.
Sawyer-Man Elec. Co.
Shelby Electric Co.
United Elec. Imp. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Lava.
Steward, D. M , Mfg. Co.

Lightning Arresters.
Central Electric Co
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Rolfe Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire. (See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
General Inc. Arc Light Co.

Mica.
Central Electric Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Bullock Elec. Mfg. Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Motors.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago Rheostat Co.
Clark, Jas. Jr., & Co.
Eagle Electric Works.
Ft. Wayne Elec. Wks , Inc.
General Electric Co.
General Inc. Arc Light Co.
Hobart Elec. Mfg. Co.
Kendrick & Davis.
Manhattan Elec. Supply Co.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Sturtevant Co., B. F.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Packing.
Besly & Co. Chas. H.
Robertson & Sons, Jas. L.

Paints.
Central Electric Co.
Cling-Surface Mfg. Co.
Eagle Paint & Varnish Wks.
Mass. Chemical Co.
Standard Paint Co.

Patent Attorneys.
Hamlin, Geo. R.
Johnston, Thomas J.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum Bought and Sold.
Baker & Co.
Goldsmith Bros.

Poles.
Berthold & Jennings.
Central Mfg. Co.
Lindsley Bros. Co.
Naugle, Holcomb & Co.
Pendleton & Gilkey.
Perrizo & Sons.
Sterling & Son, W. C.
Texas Arm & Pin Co.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester & Co., C. H.

Porcelain.
Central Electric Co.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.
Klemm & Co.

Re-Winding—Repairs.
Chicago Edison Co.
Hodge-Walsh Elec. Eng. Co.
Spies & Company.
Stewart Electrical Co.

Rheostats.
Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt Co.
Iron Clad Resistance Co.
Spies & Company.
Westinghouse El. & Mfg. Co.

Salt (Battery).
Federal Battery Co.

Second-Hand Machin'y.
Baux, F. A.
Chicago House Wrecking Co.
Hodge-Walsh Elec. Eng. Co.
Stewart Electrical Co.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.
Faries Manufacturing Co.
Klemm & Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
Barnes Co., The Wallace.
Cary Spring Works.

Steel Boxes.
Bossert Elec. Const. Co.

Stereopticons, Magic Lanterns and Slides.
Riley Bros

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.

Tapes, Insulating.
American Electrical Works.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Central Tel. & Elec. Co.
Columbia Elec. & Mfg. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Foote, Pierson & Co
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
Murdock & Co., W. J.
Noblett, E. J.
North Electric Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tl. M. Co.
Warner Co , W. F., The
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Cons. Co.
Williams Electric Co.

Tools.
Klein & Son, Mathias.

Toys, Electrical.
Kendrick & Davis.
Ohio Electric Works
Plass, E. H., Electric Co.

Transformers.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co

Translations.
Polyglot Co., The.

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Stilwell-Bierce Smith-Vaile

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Watches, Non-Magnetic.
Becken, A. C.

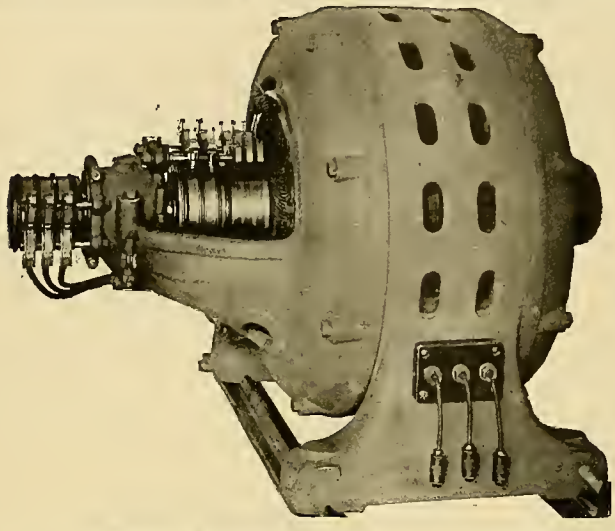
Wire, Bare.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Elect. Supply Co.

Woodwork, Electrical.
Noblett, E. J.

X Ray Outfits.
Central Electric Co.
Queen & Co.
Splitdorf, C. F.

For Alphebetical Index of Advertisements See Page III.

THE GENERAL ELECTRIC COMPANY'S
NEW TYPE OF ALTERNATOR.



75 K. W. G. E. Compensated Revolving Field Combined Alternator and Direct-coupled Exciter.

Without change of adjustment this type of alternator gives accurate automatic voltage regulation when loaded with lights, with motors or with a combination of the two, while the compounding of all other alternators requires special adjusting for similar loads. **WRITE FOR BULLETIN 4206.**

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Packed in boxes only.

FOR ALL OPEN-CIRCUIT BATTERIES
GIVES
33% More Current
AND
33% Longer Life
THAN
Sal Ammoniac.

Absolutely No Crystallizing Salts.

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SOLD IN BULK,

Gives More Current, Lasts Longer and is Cheaper than Sal Ammoniac.

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New Type Sunbeam.

110 VOLTS, 10, 16, 20, 32, 50, 100 CANDLE POWER.

ANCHORED FILAMENT.

Catalogue 1-S gives complete description and illustration of the New Type Sunbeam lamps, made by new machinery and latest improved methods. Every lamp exhausted individually.

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Electric Light and Power Apparatus,
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Electric Light and General Supplies.

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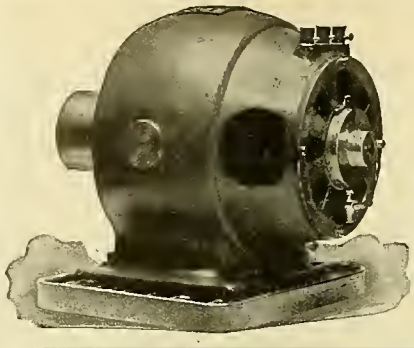
New York Philadelphia Chicago London



"Willey" Multipolar DYNAMOS AND MOTORS.

SEMI-ENCLOSED TYPE, FOR DIRECT CONNECTION.

Manufactured by

JAMES CLARK, JR., & CO.,

313 West Main St., Louisville, Ky.

Correspondence solicited.

BULLOCK GENERATORS. SEND FOR BULLETIN 2233 & 2234 BULLOCK ELECTRIC MFG. CO., CINCINNATI, O., U. S. A.

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Has been placed on the use of Automobiles by the high social factors of the country and another year no member of elite society will be up-to-date or strictly correct in every respect in his equipage unless he is the possessor of one or more Automobiles. Anticipating this, the **Woods Motor Vehicle Company** have developed and perfected beyond all further experiment under the Woods system of electrical propulsion correct styles for the coming year in over thirty different forms of vehicles, including Buggies, Traps, Brakes, Broughams, Victorias and Cabs, all of which are so simple in their operation and care that the same servants now employed can be retained, and in the lighter vehicles for ladies' and gentlemen's driving an hour's time is sufficient to learn their every manipulation.

Cost to run per mile, ½ cent. STANHOPE. Price, $2,000.00 net.

STANDARD OF THE WORLD.

Weight, 1,800 Pounds.

Mileage capacity, one charge, 35 miles.

Speed per hour, 12 miles.

The Stanhope illustrated here fills in every particular the requirements of the fastidious carriage user, as it has every feature of refinement in design and style which constitutes a carriage and not a mere machine, and one of the greatest delights in store for ladies is the usage of this character of vehicle. We strongly recommend the placing of orders early this fall and winter for spring delivery in order to insure no delay in getting such vehicles for a full season's use next year. Send for book of magnificent illustrations in latest styles of Automobiles.

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Of Every Description.

We are now manufacturing the best Dynamo Brushes in use.

We have ample facilities for supplying any description or any size of Brush.

No order is too large for us to handle or too small for our consideration.

Our material is of a superior nature and our workmanship the best.

A trial order will convince you of the many excellent qualities of our goods, which, when once used, will always be given the preference.

Our prices are right and our shipments prompt.

Write for new '99 "A" Catalogue with price list and discounts.

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American C.

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Do you want a Lamp

That will burn a minimum of 150 hours with a single 12x½ inch carbon—

That contains a clutch which will release itself without striking a trip post of any kind, a feature other manufacturers have long sought—

That throws absolutely no shadow—

That needs no alignment—

That is Ball Bearing?

THE

BELDEN LAMP

Has the above special features and many others which it will pay you to investigate if you are in the market for lamps.

Let us send you full particulars of this money maker.

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Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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The Fibre-Graphite Commutator Brush.

(U. S. and Foreign Patents.)

No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.

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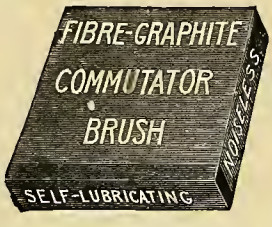

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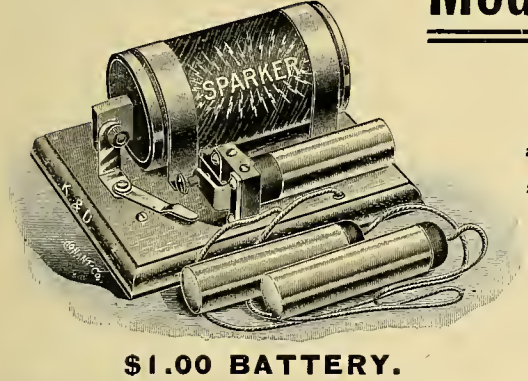

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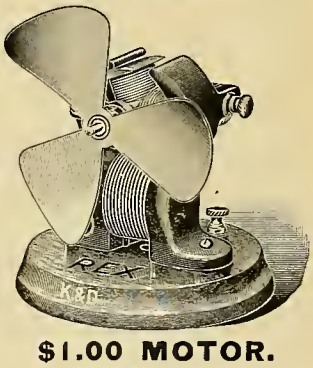

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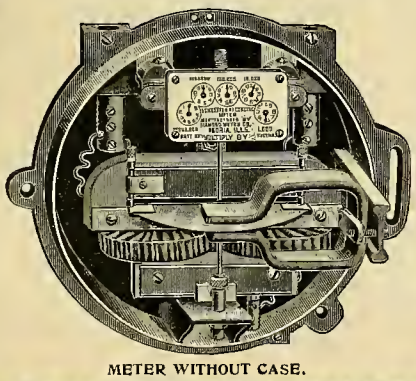

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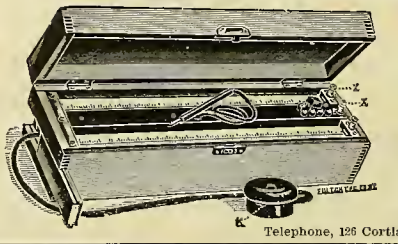

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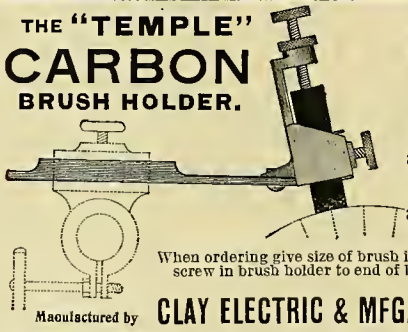

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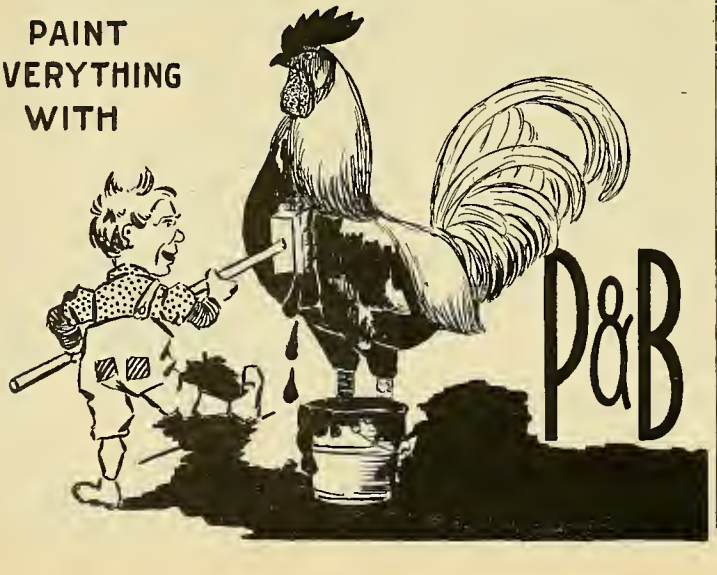

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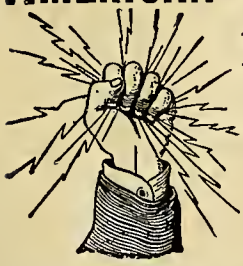

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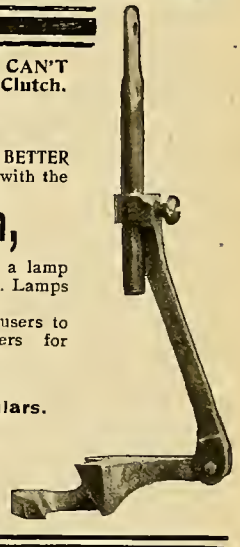

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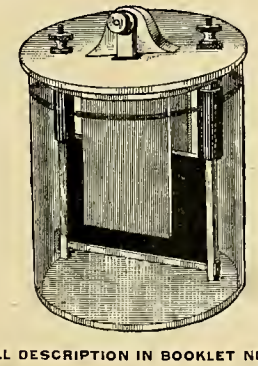

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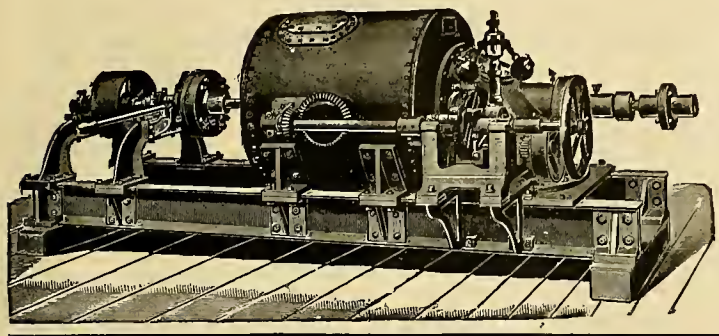

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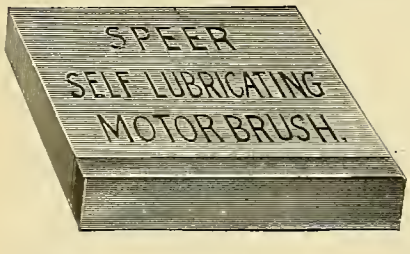

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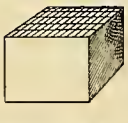

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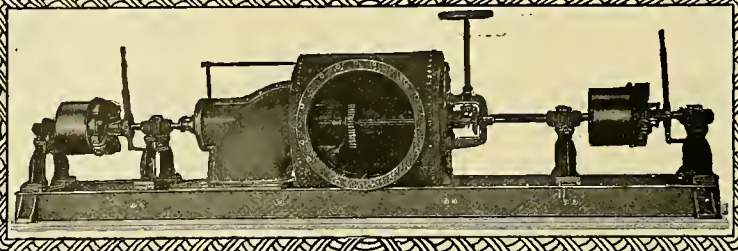

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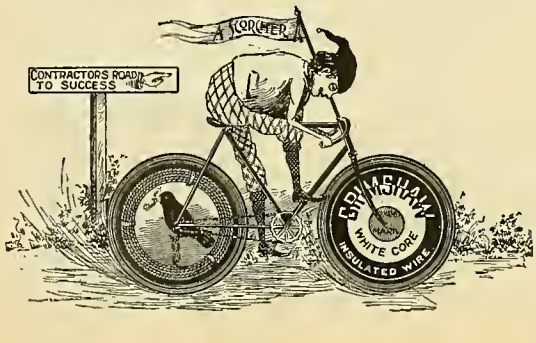

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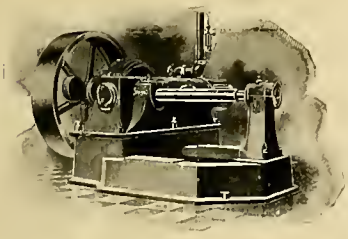

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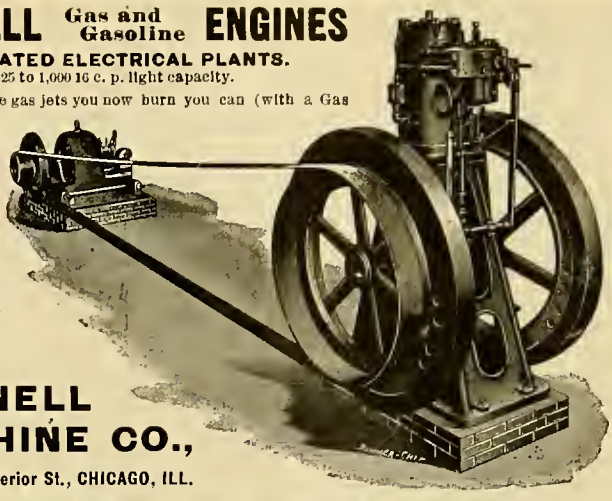

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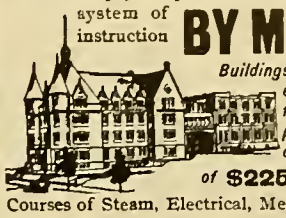

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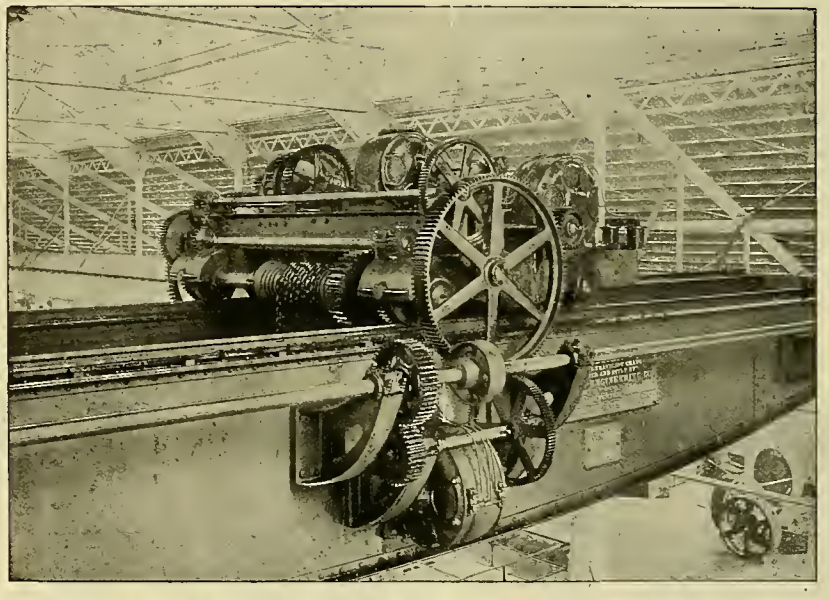

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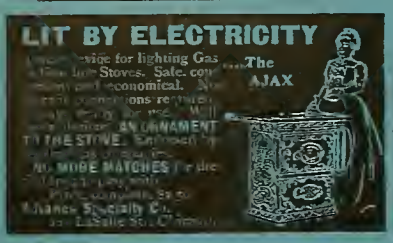

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This Powder is put up in 10 and 25 pound cans.

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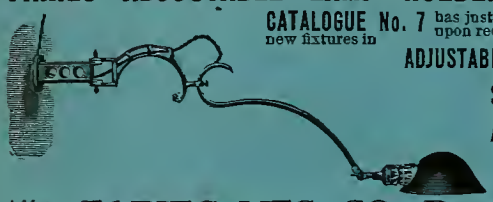

CATALOGUE No. 7 has just been issued and will be mailed upon request. It shows a number of new fixtures in

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THE HART H. & H. PUSH SWITCH

IS WITHOUT A PEER.

IT IS EASY TO PUSH.

THE ACTION IS POSITIVE.

THERE IS NO PAINFUL JAR TO THE FINGER WHEN OPERATING.

THE DESIGN, WORKMANSHIP AND MATERIAL ARE THE BEST THAT CAN BE OBTAINED.

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Also in gangs of any number up to eight.

We make a special line of Iron Wall Boxes and Frames for the installation of these goods.

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CHICAGO: MONADNOCK BLOCK.

WESTERN ELECTRICIAN

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Vol. XXV. CHICAGO, DECEMBER 9, 1899. No. 24

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RUBBER COVERED, WEATHERPROOF, UNDERGROUND AND SUBMARINE.

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THE STANDARD FOR RUBBER INSULATION.

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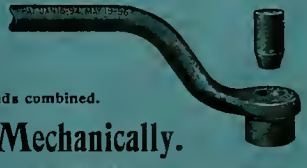

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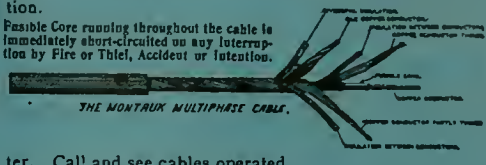

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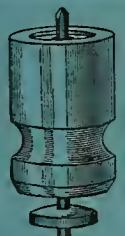
They are the most reliable, absolute standards for Laboratory use.



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CARPENTER ENAMEL FIELD RHEOSTAT.

	125 VOLTS.					
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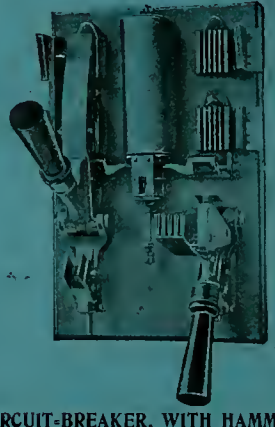

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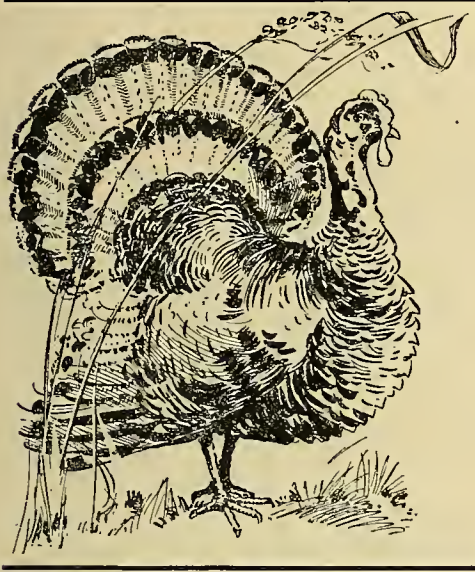

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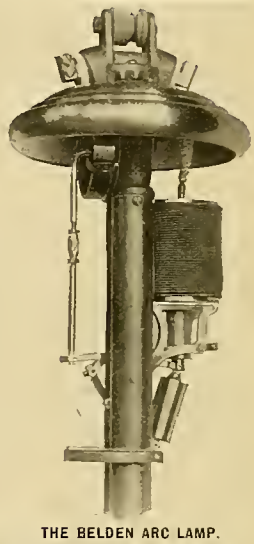
FORT WAYNE, IND.



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Get posted on its good points.

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PAILLARD
NON-MAGNETIC
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ENDORSED BY THE GREATEST ELECTRICIANS AND SCIENTISTS OF THE WORLD.

A USEFUL GIFT!

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FOR DESCRIPTIVE CIRCULAR WRITE
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WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

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Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

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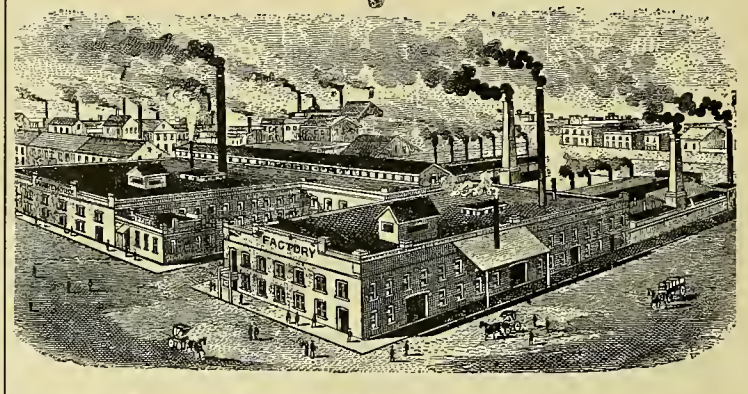

We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

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ST. LOUIS, MO.

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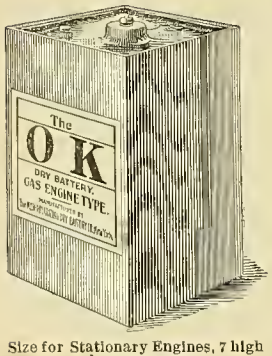
NEW GAS ENGINE TYPE.



Size for Stationary Engines, 7 high by 4½ square.
Size for Automobiles, 7 high by 4 square.

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No Solution to slop over. No Missing of sparks.
Highest Voltage.
Quickest Recuperation. Long Life.
Unaffected by heat or cold. Compactness.

BOXED, CONNECTED, COMPLETE, READY TO BE HITCHED TO ENGINE.

POINTS IN ORDERING.

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6. Kind of spark contact points, whether platinum, steel or other material.
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OKONITE IT NEVER DISAPPOINTS

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OKONITE IT NEVER DISAPPOINTS

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FOR ALL OPEN-CIRCUIT BATTERIES
GIVES
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THAN
Sal Ammoniac.

Absolutely No Crystallizing Salts.

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Gives More Current, Lasts Longer and is Cheaper than Sal Ammoniac.

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Mesco Dry Battery.
Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2½x6½
We make all sizes.

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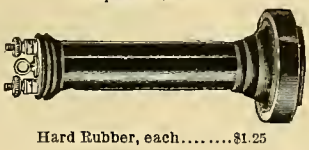
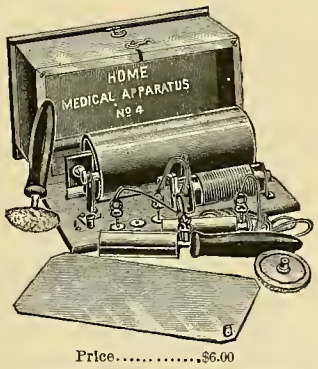
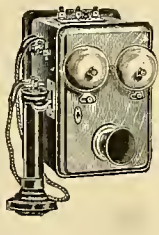


Hard Rubber, each.....$1.25

Battery Zincs.
We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....$6.00
We make a number of different styles.

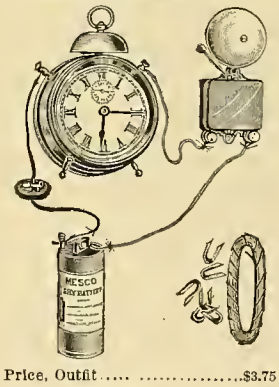


Telephone Outfit, No. 14,

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

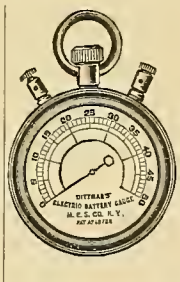
Alarm Clock Outfit, No. 1½.



Price, Outfit.....$3.75
" Clock only..... 2 25

Pony Telephone Receiver.

Retail price, 90 cents.



Dittmar Pocket Battery Gauge.

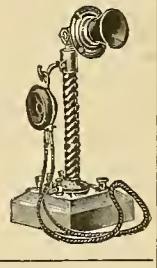
Will register the strength of open or closed circuit batteries.

Price each, $3.50.

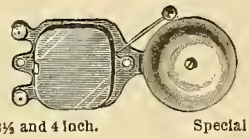
Desk Telephone Outfit, No. 11.

Price.....$9.00

We make a dozen different Telephone Outfits.



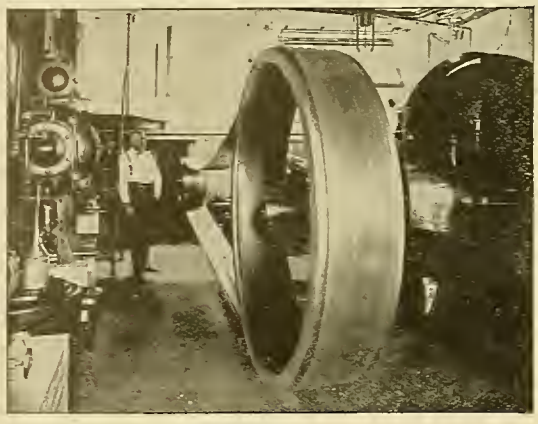
Iron Box Bells, No. 97.



2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.



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Dear Sirs:—Having tried Cling-Surface on my 12-inch dynamo belt (16 feet between centers), I have been able to carry full load with 22-inch sag on belt with no perceptible slip. It surpasses my expectations and I can recommend it to do all that is claimed for it, if directions are followed. Yours respectfully, E. B. PRESCOTT, Engineer.

AN EASY BELT MADE POSSIBLE BY

CLING-SURFACE

Means a saving of time, money, belt and bearings, to say nothing of the engineer's comfort.

There is no better belt preservative known than Cling-Surface.

We have something to say.
Write Us.

CLING-SURFACE MFG. CO.,

177-182 VIRGINIA ST., BUFFALO, N. Y.

CHICAGO BRANCH: 225 Dearborn St.

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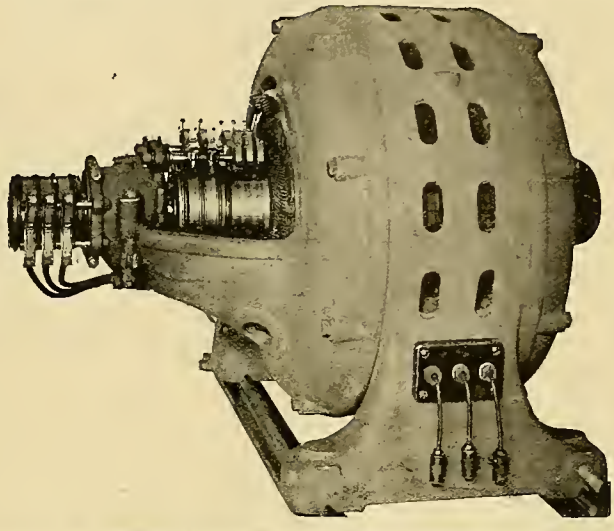
NEW TYPE OF ALTERNATOR.



75 K. W. G. E. Compensated Revolving Field Combined Alternator and Direct-coupled Exciter.

Without change of adjustment this type of alternator gives accurate automatic voltage regulation when loaded with lights, with motors or with a combination of the two, while the compounding of all other alternators requires special adjusting for similar loads. **WRITE FOR BULLETIN 4206.**

Main Office: SCHENECTADY. **Sales Offices in all Large Cities.**

INCANDESCENT LAMPS
G. & W.

LIFE--Because they are Well Made.
EFFICIENCY--Because the filaments are the Best.
ECONOMY--Because they are Lower in Price and give better light with less consumption of current than any other lamp on the market.

SPECIAL PRICES offered to Electrical Supply Houses, Power Plants, Railways and all large users of Incandescent Lamps.

OUR LAMPS ARE
OUR BEST SALESMEN.
LET US SEND YOU SAMPLES.

GOODCHILD & WELSH,
149 Academy St., NEWARK, N. J.

THE PERFECT **VACUUM** DOES IT.

Made of the Highest Grade Materials, and by Latest Process known. Quality Guaranteed.

EACH LAMP EXHAUSTED INDIVIDUALLY, WHICH INSURES EFFICIENCY, CANDLE POWER AND ECONOMY IN CONSUMPTION OF CURRENT.

MAINTAIN YOUR VOLTAGE

The Lamp Will Do The Rest.

Prices F. O. B., Owensboro, Ky., 8, 10, 16 C. P., Bbl. Lots, 17c each. 32 C. P., Bbl. Lots, 25c each. Either E., T.-H. or W. H. Bases.

TRY A BARREL AND BE CONVINCED.

MANUFACTURED BY...

KENTUCKY ELECTRICAL CO., OWENSBORO, KENTUCKY.
INCORPORATED.

NEW TYPE SUNBEAM.

220 VOLTS. 8, 10, 16, 32, 50 CANDLE POWER.

We make a specialty of High Voltage Incandescent Lamps.

Catalogue 1-S gives complete description and illustration of the New Type Sunbeam lamps, made by new machinery and latest improved methods. Every lamp exhausted individually.

WESTERN ELECTRIC COMPANY
CHICAGO. NEW YORK.

MANUFACTURERS AND DEALERS,

Electric Light and Power Apparatus,
Arc and Incandescent Lamps, Wire, Cable,
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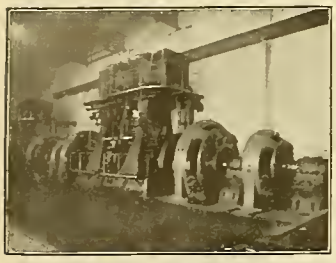

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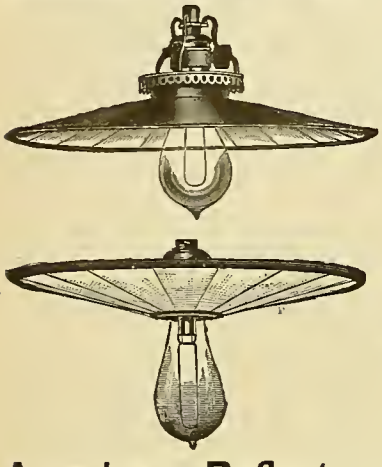

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A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

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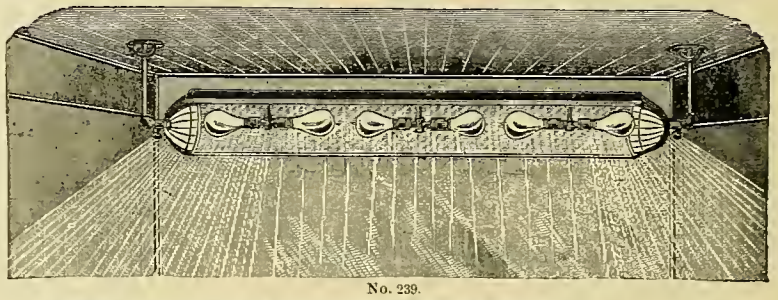

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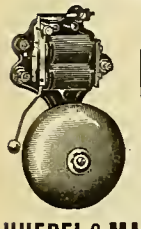
Send for Catalogue of Reflectors for Stores, Churches and general purposes.



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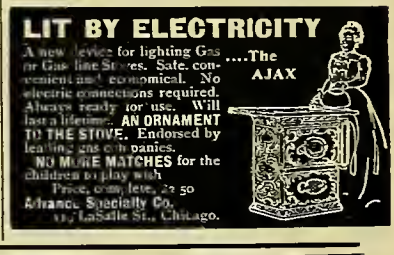

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IT IS EASY TO PUSH.

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THERE IS NO PAINFUL JAR TO THE FINGER WHEN OPERATING.

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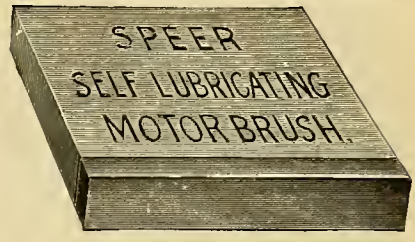

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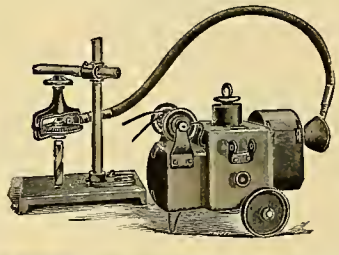

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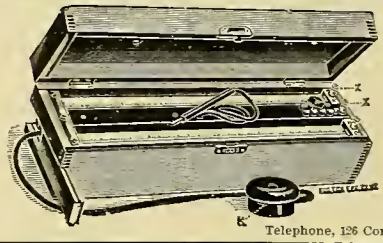

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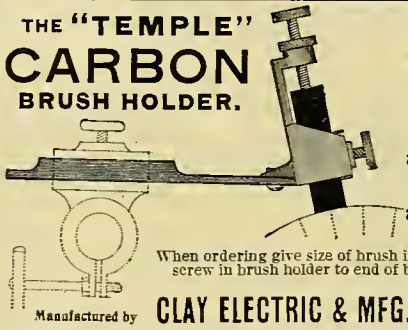

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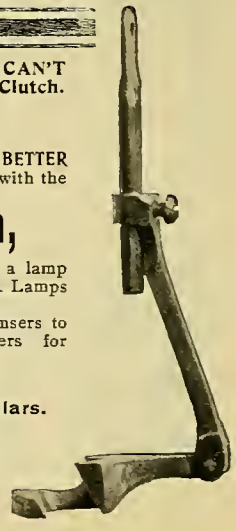

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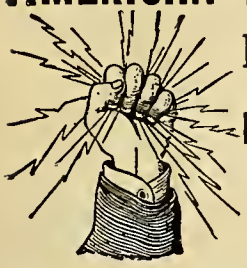

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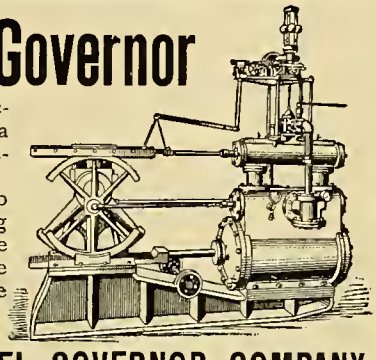

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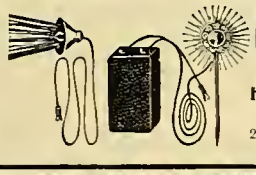

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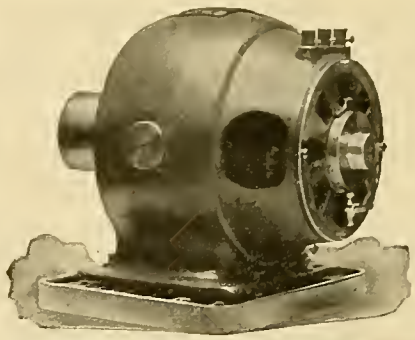

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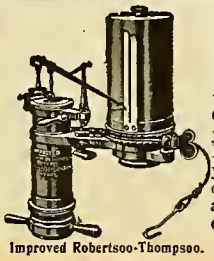

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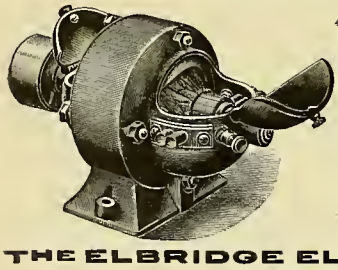

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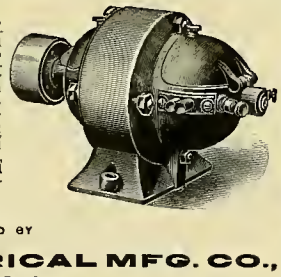

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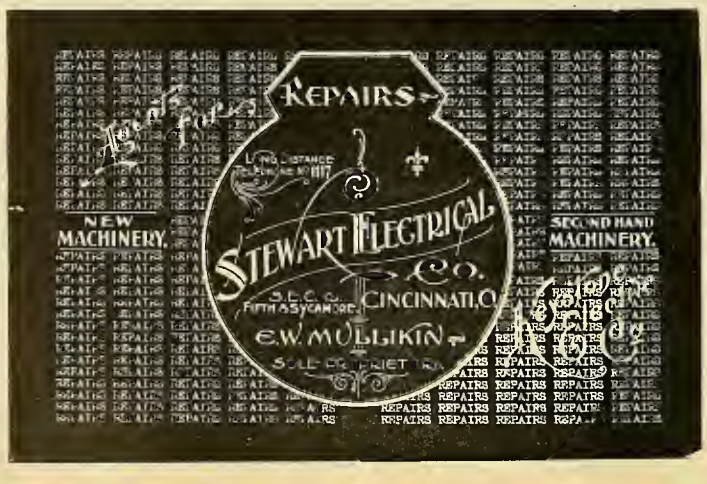

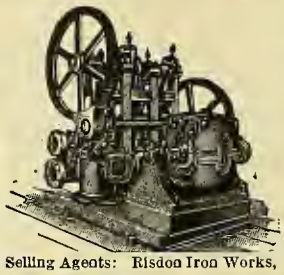

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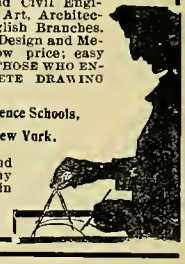

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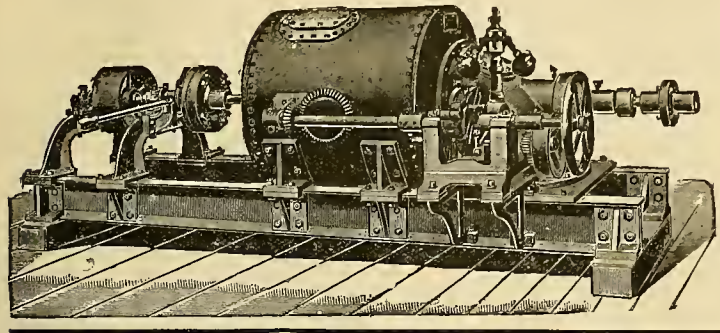

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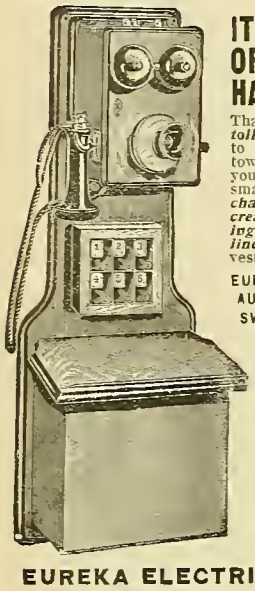

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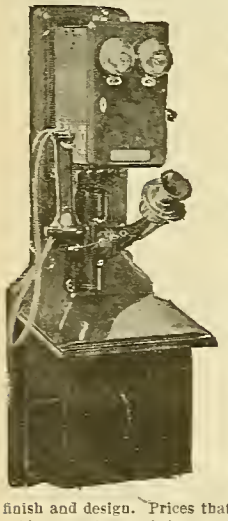

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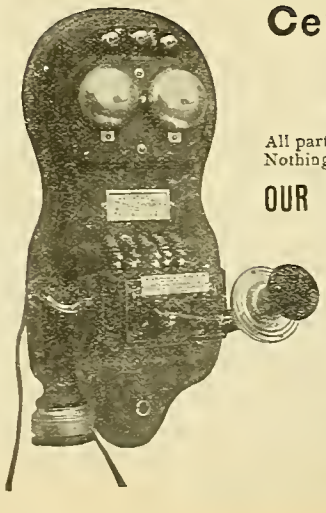

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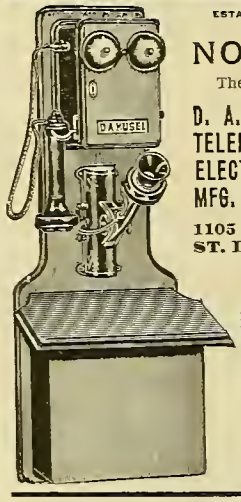

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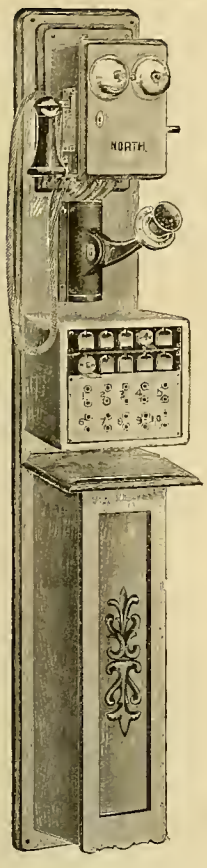

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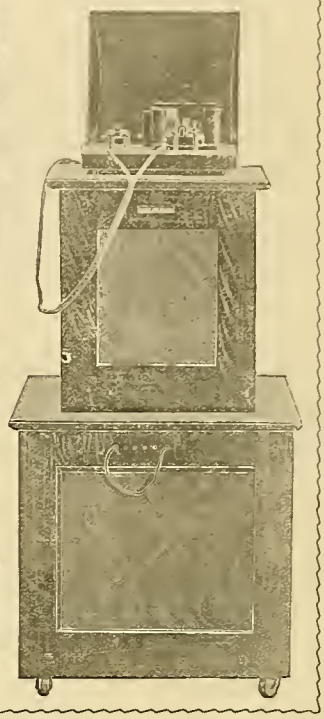

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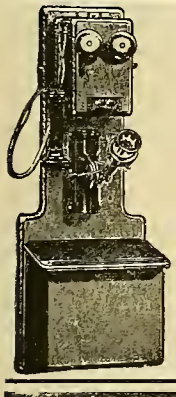

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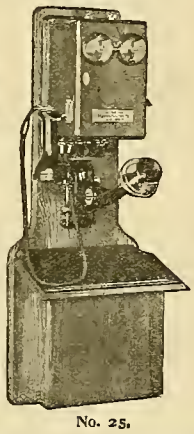

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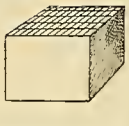

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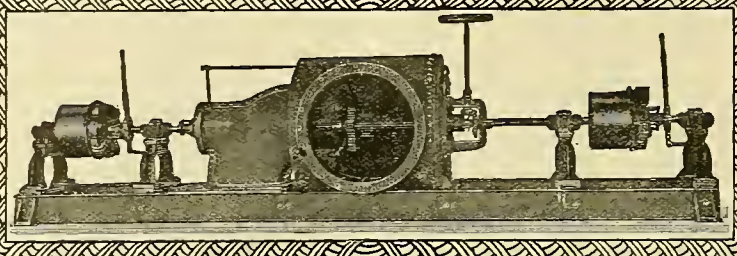

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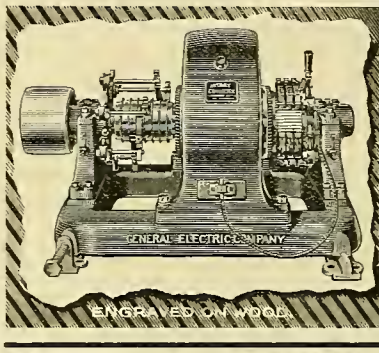

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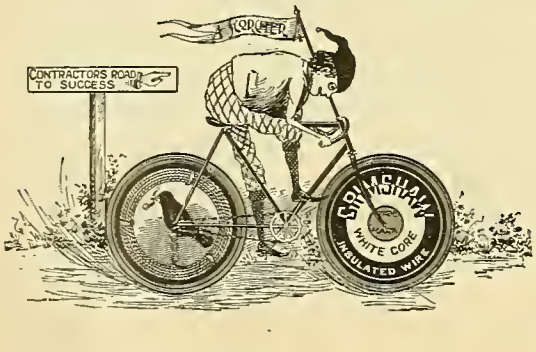

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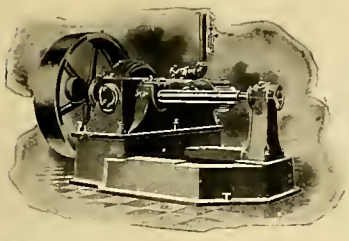

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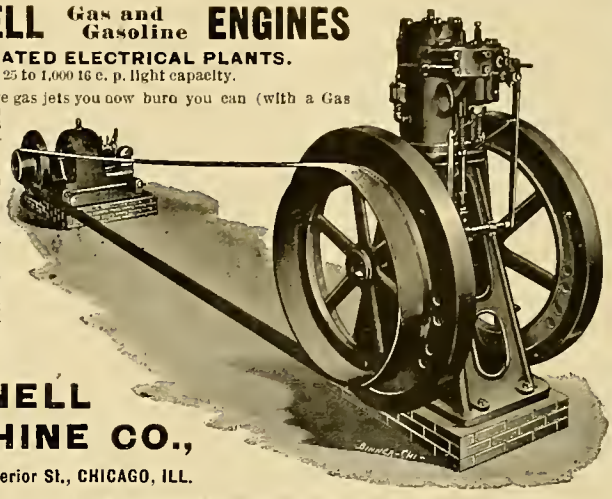

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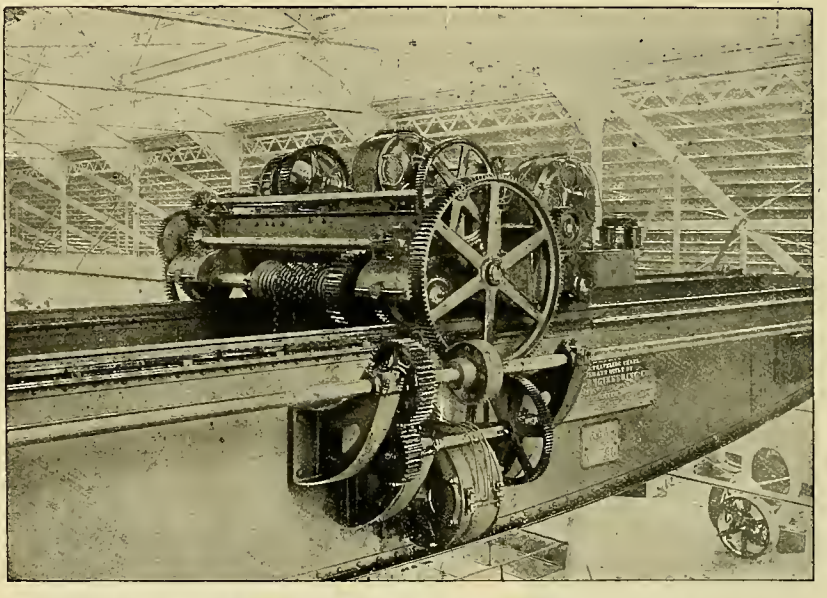

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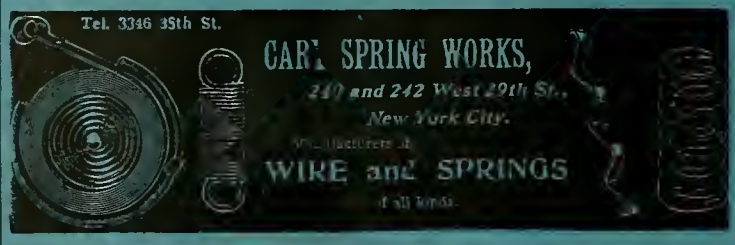

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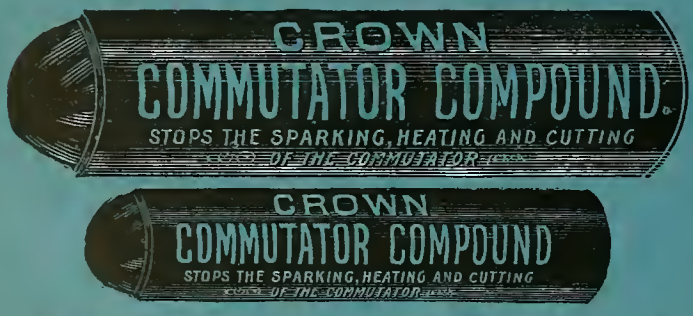

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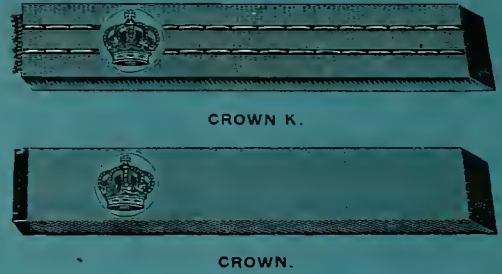

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Vol. XXV. CHICAGO, DECEMBER 16, 1899. No. 25

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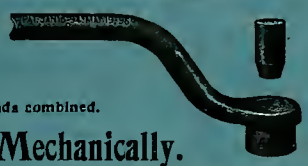

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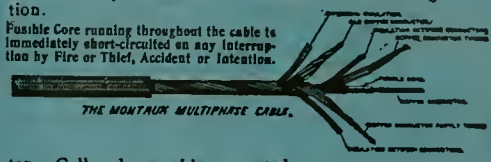

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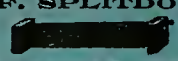
X-Ray Coils, Telephone Coils.  Medical Coils, Spark Coils.

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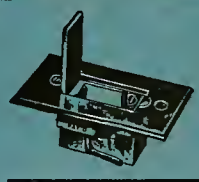

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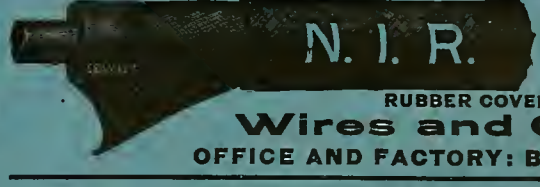

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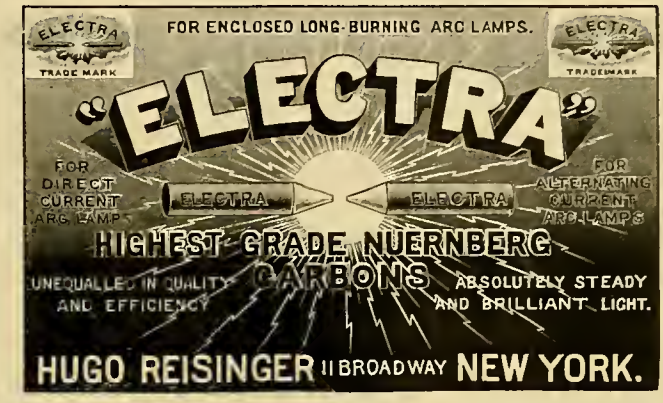

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

DOES

Your Electric Light or Street Railway Plant Pay Satisfactory Dividends?

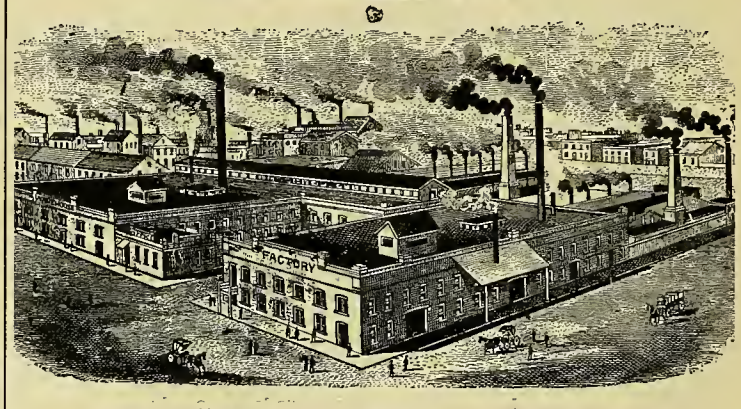
If not, why don't you remodel and put it on a paying basis? That's a specialty of our business.

HAYS CONSTRUCTION CO.,

CONSULTING ENGINEERS,

TROY, OHIO.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

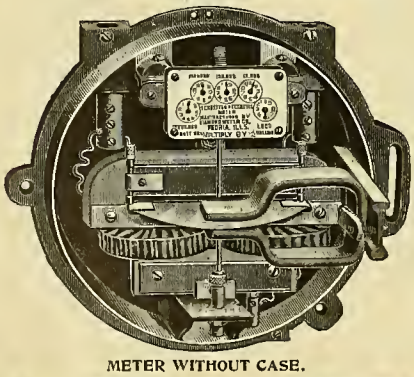
We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

SCHEEFFER RECORDING WATT-METERS.



METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,

PEORIA, ILL., U. S. A.

METER WITH CASE.

Small Lamps for the Little Folks, Large Ones for the Grown People.

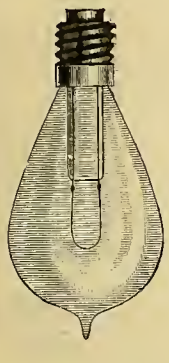
All add to the **Holiday Decorations** and are intended for use on battery or incandescent lighting circuits and furnished either in natural glass or artificial colors.

MINIATURE LAMPS

For battery currents require from 3 to 7 volts and give from 1 to 6 candle power. Those for incandescent circuits of 50 to 110 volts are intended to burn singly or in series. The candle power is from 1 to 8.

COMMERCIAL LAMPS

of Columbia make are from 10 to 50 candle power. The 10 and 16 c. p. are also made in natural glass colors. We artificially color any size of lamp, or will supply Vitro Chrome or Zero Frost for lamp treatment at home.



The "Ever Ready" Banquet and Bedroom Lamps make Attractive and Useful Presents.

CATALOGS AND PRICES UPON ALL TYPES OF LAMPS. WRITE US.

Central Electric Company,

264-270 Fifth Avenue,
Chicago, Ill.

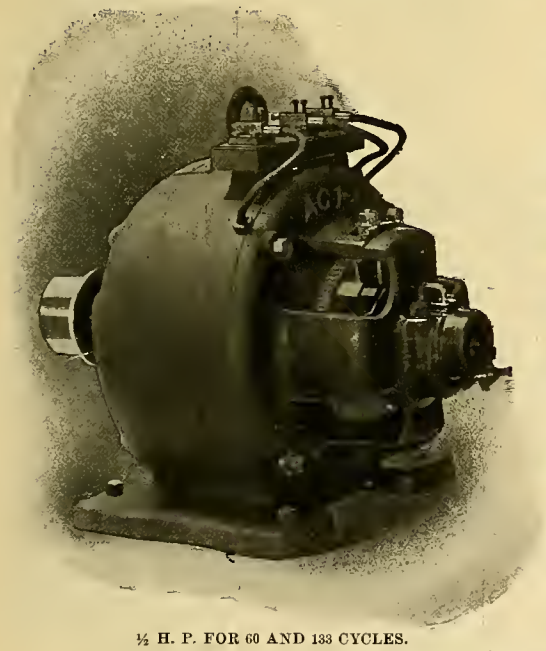
OKONITE — IT NEVER DISAPPOINTS

Southern Electrical Supply Co.,
St. Louis.

NOW READY.

Small Single-Phase Self-Starting A. C. Motors

SUPPLEMENTING OUR WELL-KNOWN LIST OF STANDARD SIZES.



Simple,
Efficient,
Guaranteed,
Durable,
Low Cost of Installation,
Require No Attention.

½ H. P. FOR 60 AND 133 CYCLES.

SEND FOR BULLETINS 24, 26 AND 32.

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CHICAGO, 1519 Marquette Bldg., Geo. B. Foster, Agent.
SAN FRANCISCO, 120 Sutter St., A. R. Pike, Agent.
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Won't chatter like a monkey when the circuit is closed.

BELDEN

Won't flicker and splutter before settling down to work.

ARC

Won't require aligning when carbons are renewed or trimmed.

LAMP

There are several things it WILL do, which our booklet will explain—sent on request.

—THE—

BELDEN-LARWILL Electric & Mfg. Co.,

FT. WAYNE, IND., U. S. A.

THE LIGHTS FLICKER BECAUSE THE BELTS SLIP IN ELECTRIC-LIGHT STATIONS

And the Power is unequal.
Belts filled with Cling-Surface do NOT slip, but run steadily and smoothly. Because they do not slip they can be relieved of tension and run easy, yet will transmit at least fifteen per cent. more power. Cling-Surface is not a belt dressing, but is a belt filler, and does not make a sticky belt—yet they never slip. And Cling-Surface is one of the BEST BELT PRESERVATIVES KNOWN. Your belts are valuable, and you are afraid of belt dressings but so are the BELTS of Fraser & Chalmers, Chicago; Union Traction Co., Philadelphia; American Steel and Wire Co., Worcester, Mass., and General Electric Co. Lamp Works, and they use and value Cling-Surface. Let us tell you more about it.

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NEW ENGLAND BRANCH: 170 SUMMER STREET, BOSTON.

CLING-SURFACE MFG. CO., 177-182 Virginia St., BUFFALO, N. Y.

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Belting.
Chicago Belting Co.
Leather Preserver Mfg. Corp.
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Bryan & Bamphrey.
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Chicago Fuse Wire & Mf. Co.
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Peru Elec. Mfg. Co.
Schiff, Jordan & Co.
Western Electric Co.
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Globes and Electrical Glassware.
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Holders, Inc. Lamp.
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Chicago Insulated Wire Co.
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Kartavert Mfg. Co.
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Mica Insulator Co.
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Standard Paint Co.
Standard Underground C. Co.
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American Steel & Wire Co.
Central Electric Co.
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Chicago Insulated Wire Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
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Montauk Multiph. Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
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Mass. Chemical Co.
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Patent Attorneys.
Bamlin, Geo. R.
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Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
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Iron Clad Resistance Co.
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Spies & Company.
Westinghouse El. & Mfg. Co.

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Federal Battery Co.

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Chicago House Wrecking Co.
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Stewart Electrical Co.
Walsh's Sons & Co.

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Amer. Reflector & Ltg. Co.
Faries Manufacturing Co.
Klemm & Co.
Pacific Electric Co.

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Central Electric Co.
Electric Appliance Co
Manhattan Elec. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
Barnes Co., The Wallace.
Cary Spring Works.

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Bossert Elec. Const. Co.

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Riley Bros.

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American Electrical Works.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
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Central Tel. & Elec. Co.
Columbia Elec. & Mfg. Co.
Conch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Foote, Pierson & Co
Kokomo Tel, & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
Murdock & Co., W. J.
Noblett, E. J
North Electric Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co.
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Klein & Son, Mathias.

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Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
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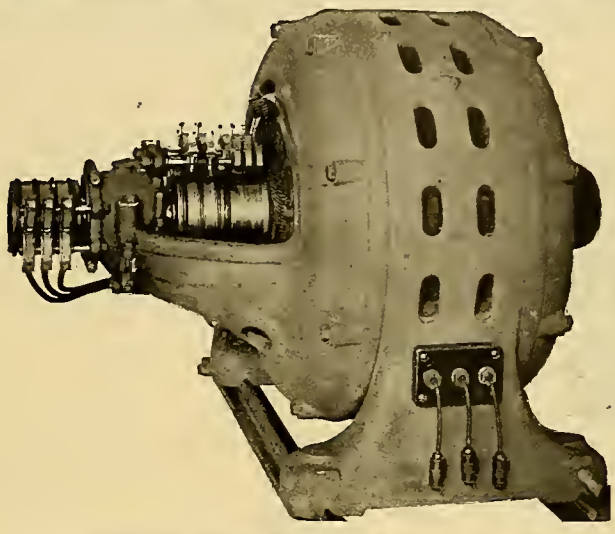
Western Elect. Supply Co.

Woodwork, Electrical.
Noblett, E. J.

X Ray Outfits.
Central Electric Co.
Queen & Co
Splitdorf, C. F.

For Alphabetical Index of Advertisements See Page III.

THE GENERAL ELECTRIC COMPANY'S
NEW TYPE OF ALTERNATOR.



75-Kw. G.E. Compeosated Revolving Field Combined Alternator and Direct-coupled Exciter.

Without change of adjustment this type of alternator gives accurate automatic voltage regulation when loaded with lights, with motors or with a combination of the two, while the compounding of all other alternators requires special adjusting for similar loads. WRITE FOR BULLETIN 4206.

Main Office: SCHENECTADY. **Sales Offices in all Large Cities.**

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Has been placed on the use of Automobiles by the high social factors of the country and another year no member of elite society will be up-to-date or strictly correct in every respect in his equipage unless he is the possessor of one or more Automobiles. Anticipating this, the **Woods Motor Vehicle Company** have developed and perfected beyond all further experiment under the Woods system of electrical propulsion correct styles for the coming year in over thirty different forms of vehicles, including Buggies, Traps, Brakes, Broughams, Victorias and Cabs, all of which are so simple in their operation and care that the same servants now employed can be retained, and in the lighter vehicles for ladies' and gentlemen's driving an hour's time is sufficient to learn their every manipulation.

Cost to run per mile, ½ cent. STANHOPE. Price, $2,000.00 net.

STANDARD OF THE WORLD.

Weight, 1,800 Pounds.

Mileage capacity, one charge, 35 miles.

Speed per hour, 12 miles.

The Stanhope illustrated here fills in every particular the requirements of the fastidious carriage user, as it has every feature of refinemeot in design and style which constitutes a carriage and not a mere machine, and one of the greatest delights in store for ladies is the usage of this character of vehicle. We strongly recommend the placing of orders early this fall and winter for spring delivery in order to insure no delay in getting such vehicles for a full season's use next year. Send for book of magnificent illustrations in latest styles of Automobiles.

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New Type Sunbeam Street Railway Lamp.

16 CANDLE POWER.

Catalogue 1-S gives complete description and illustration of the New Type Sunbeam lamps, made by new machinery and latest improved methods. Every lamp exhausted individually.

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Arc and Incandescent Lamps, Wire, Cable,
Telegraph, Station and Measuring Instruments,
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ANTWERP, 33 Rue Boudewyns.

PARIS, 46 Avenue de Breteuil.

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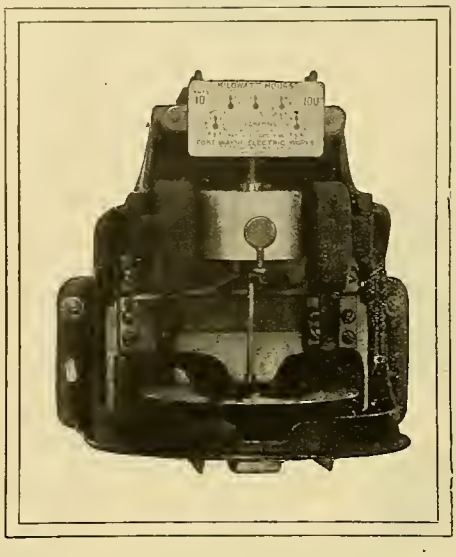
(INCORPORATED)



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Register accurately from 1-100 of full load to 50 per cent. overload.

THE ADJUSTABLE FRICTION COMPENSATOR is described in our new meter book. Drop us a postal for a copy.

MAIL ORDERS WILL RECEIVE SPECIAL ATTENTION AND BE SHIPPED PROMPTLY.

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FOR LIST OF MANUFACTURES SEE CLASSIFIED INDEX.

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Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

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1,000,000 sold during the past twelve months.

Mesco Dry Battery.

Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

Standard size, 2¼x6½

We make all sizes.

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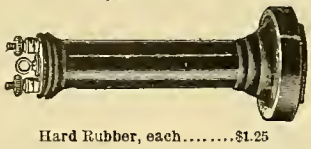
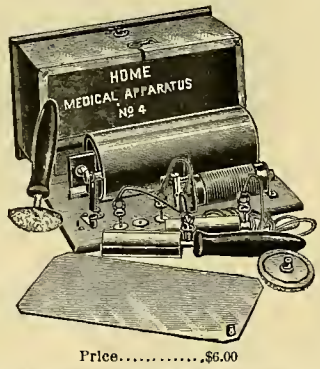


Hard Rubber, each.....$1.25

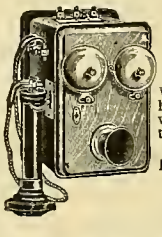
Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.



Price.....$6.00

We make a number of different styles.

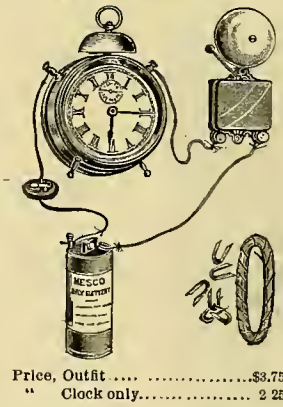


Telephone Outfit, No. 14.

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

Alarm Clock Outfit, No. 1½.

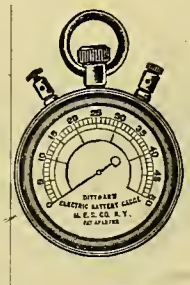


Price, Outfit.....$3.75

" Clock only..... 2 25

Pony Telephone Receiver.

Retail price, 90 cents.



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Will register the strength of open or closed circuit batteries.

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Desk Telephone Outfit, No. 11.

Price.....$9.00

We make a dozen different Telephone Outfits.

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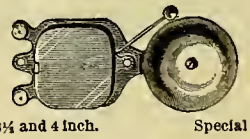

2½, 3, 3½ and 4 inch. Special prices

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

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MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.

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Drug and Chemical Works,
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Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

BULLOCK MOTORS. SEND FOR BULLETIN 2232 & 2233 BULLOCK ELECTRIC MFG. CO. CINCINNATI, O., U. S. A.

BULLOCK GENERATORS. SEND FOR BULLETIN 2233 & 2234 BULLOCK ELECTRIC MFG. CO. CINCINNATI, O., U. S. A.

WE HAVE NO COMPETITORS except in price for

WOVEN WIRE DYNAMO BRUSHES.

OUR QUALITY IS PARAMOUNT.

AMERICAN. AMERICAN "C."

Woven Wire Brushes of every description. Quality first, last and always. We make but one grade—THE BEST.

If you are using Woven Wire Brushes be sure you get the best—THE AMERICAN. **LOW PRICE, HIGH QUALITY.** If you will send us a trial order we are satisfied your future orders will be placed with us.

American Woven Wire Brush Co.,
27 WALNUT STREET, PEABODY, MASS.

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Motor and Generator BRUSHES.

Speer Carbon Co.,

ST. MARYS, PA.

We Excel and Undersell All.

Battery Hanging Lamps,	$10.00
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Genuine Electric Insoles,	.25
Telegraph Outfits,	2.25
Battery Motors from $1 to	12.00
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Necktie Lights, 75 cts. to	3.00
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Electric Railway,	2.95
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All Electrical Books at low prices.

We undersell all on Everything Electrical.

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Headquarters for Electric Novelties and Supplies. Agents wanted. Send for New Catalogue just out.

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The Fibre-Graphite Commutator Brush.

(U. S. and Foreign Patents.)

No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.

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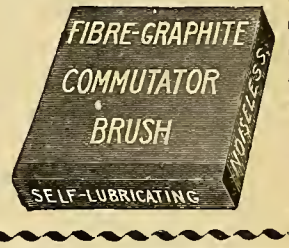

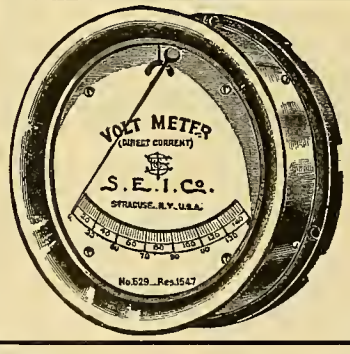

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Send for descriptive catalogue and prices.

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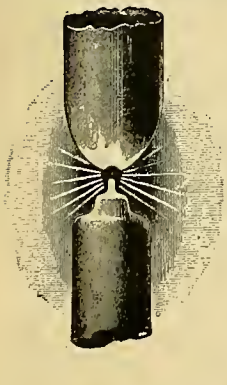

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FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

NATIONAL CARBON COMPANY,

1198 West Madison Avenue, CLEVELAND OHIO.

A-B
ENCLOSED ARC LAMPS
FOR ALL CIRCUITS.

They Save Time, Expense and Trouble.
WE SEND PAMPHLETS.

ELECTRIC APPLIANCE COMPANY, Chicago,
AMERICA'S LARGEST ELECTRICAL SUPPLY HOUSE.
(MAKERS OF EACO TAPE.)

A COMMUTATOR NECESSITY!

50 CENTS PER STICK. $5.00 PER DOZEN.
Upon Receipt of this COUPON we will Send FREE, Sample Stick.

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Address .....
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The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
ABSOLUTELY WILL NOT GUM THE BRUSHES....
It will put that high gloss on the commutator you have so long sought after.
For Sale by all Supply Houses, or
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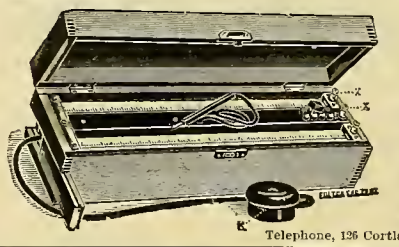
Sole Manufacturers,
909 Title and Trust Bldg., CHICAGO, ILL.



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The Only Instrument to Measure a Resistance
Quickly and Accurately
The American Electric Specialty Co.,
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Electrical Instruments, Automatic Switches Arc Lamps, Special Machinery.
Agents for CHAS. WIRT & CO., Rheostats and Brushes.
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IN ANY SHAPE OR PATTERN.
FOR ARMATURE COILS AND FIELDS.
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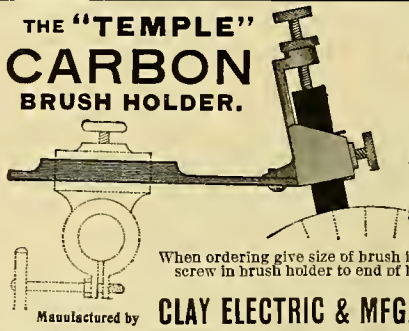
EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
(General Electric Co.) Harrison, N. J.

THE "TEMPLE"
CARBON BRUSH HOLDER.



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Designed to replace Copper Brushes on Dynamos and Motors.
Made in all sizes and fit all makes of machines.

When ordering give size of brush in use, also distance from center of binding screw in brush holder to end of brush. Descriptive circular sent upon request.
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MANUFACTURERS OF
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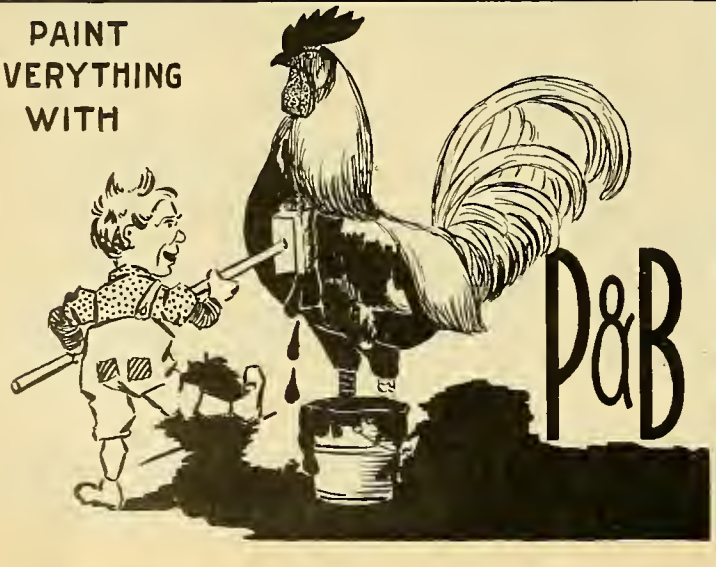

P&B

A new T.-H. Arc Lamp is hard to beat, and you CAN'T beat it if you fit it up with the **Knutson Gravity Clutch.**

YOUR OLD T.-H. ARC LAMPS

Will be good as new if you fix them up RIGHT, and BETTER if you take out old-style clutches and fit them up with the

Knutson Gravity Clutch,

The only clutch ever made that can be put in a lamp without taking rods out. We can FIX your T.-H. Lamps and make them better than they ever were.
We wish also to call the attention of arc lamp users to our one-piece upper and lower carbon holders for ½-inch and ⅝-inch carbons.

Write Us for Prices and Particulars.

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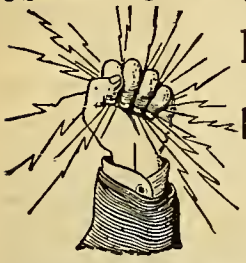
PROVIDENCE, R. I.



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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

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FOR SWITCHBOARD, RAILWAY and MOTOR USE.

All sizes of Stranded and Flexible Wire and Cables with Clark's Insulation

Inspector Boston Fire Underwriters' Union says:
"A thoroughly reliable and desirable wire in every respect."

The Clark wire has been before the public and in use for the past ten years, and has met with universal favor. We guarantee our insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class insulated wire. We shall be pleased to mail Catalogues, with terms and discounts for quantities.

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HERBERT H. EUSTIS, Pres. and Electrician.

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EVERY RHEOSTAT WE MAKE and sell is intended to sell more as a result of its operation. A large number have been sold in that way, and more and more are being sold because those already in service are proving their worth in hard, everyday use. If you want to be sure of getting a high-class Rheostat, get a C. & H.

THE CUTLER-HAMMER MFG. CO.,

12th and St. Paul Sts., MILWAUKEE, WIS. 136 Liberty St., NEW YORK.

The largest and widest exclusive manufacturers of rheostats in the world. Write for prices and particulars.

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Yes, you can. We teach ELECTRICAL ENGINEERING at your home BY MAIL at a cost within the reach of anyone. No matter where you live, if you can read and write, we guarantee to teach you thoroughly. Our institute is endorsed by THOMAS A. EDISON and other prominent men of the country. We teach also MECHANICAL ENGINEERING, MECHANICAL DRAWING, MACHINE DESIGN, TELEGRAPHY, TELEPHONY, ELECTRIC RAILWAYS, ELECTRO-THERAPEUTICS, ELECTRIC MINING, etc., by mail. Write for Catalogue. State subject you wish to study. The Electrical Engineer Institute of Correspondence Instruction, Dept. K, 120-122 Liberty St., New York.

I consider the Electrical Engineer Institute of Correspondence Instruction conducted by Messrs. Wheeler and Morton to be of great value to those who desire an Electrical education.
Thomas A. Edison

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Six years with General Electric Co.

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Consulting Engineer,
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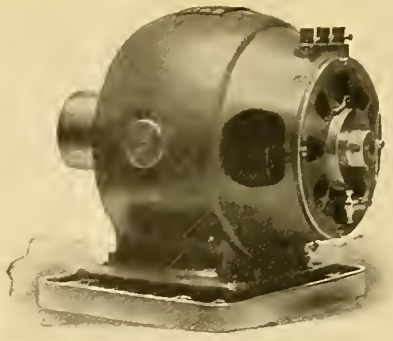
Solicitor of Patents
Expert in patent cases.
Suite 1657-59 Monadnock Bldg., - Chicago.



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DYNAMOS
AND
MOTORS.
SEMI-ENCLOSED TYPE,
FOR DIRECT CONNECTION.
Manufactured by
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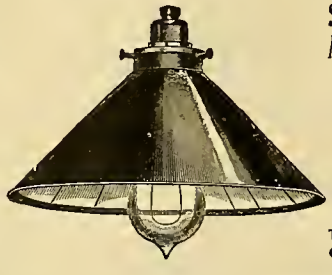

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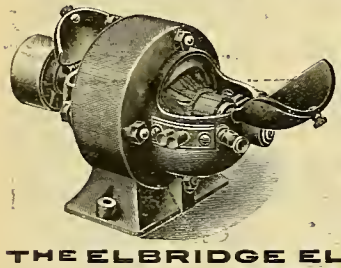

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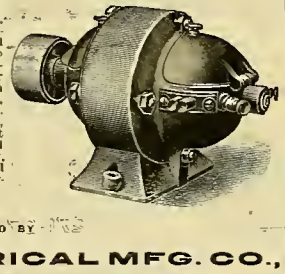

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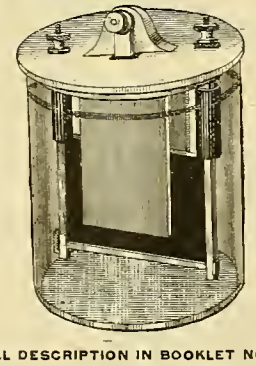

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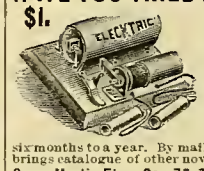

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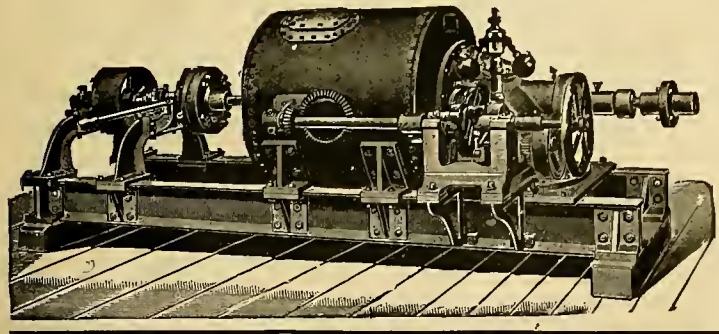

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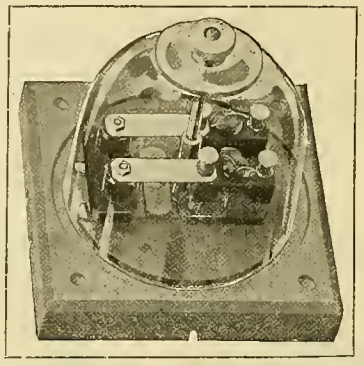

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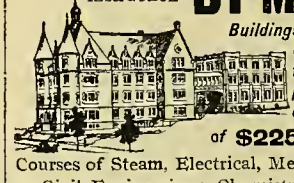

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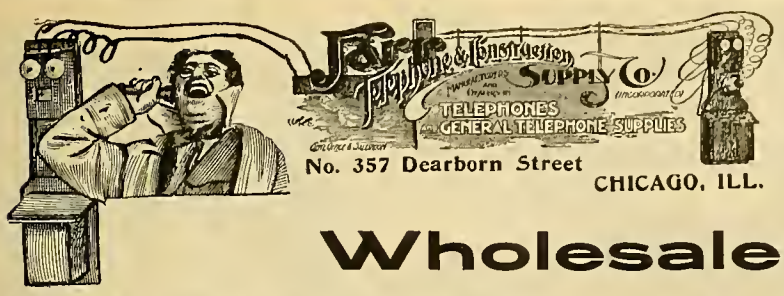

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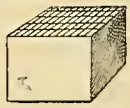

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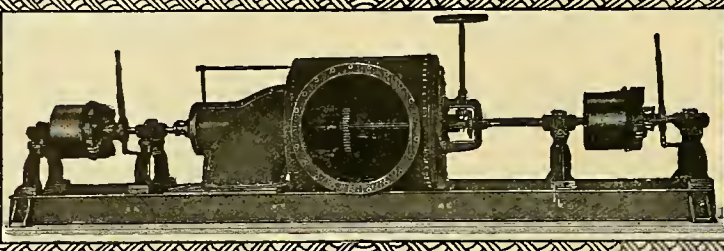

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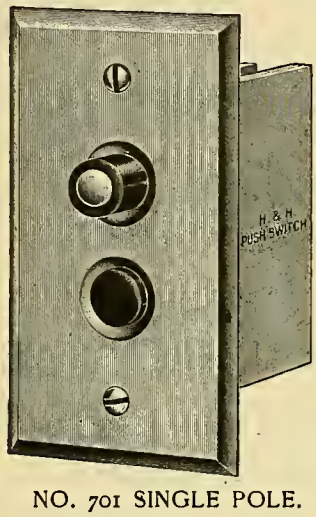

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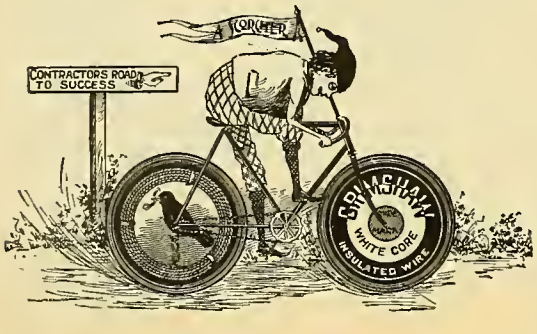

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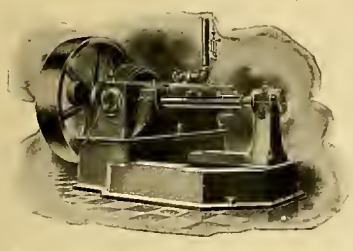

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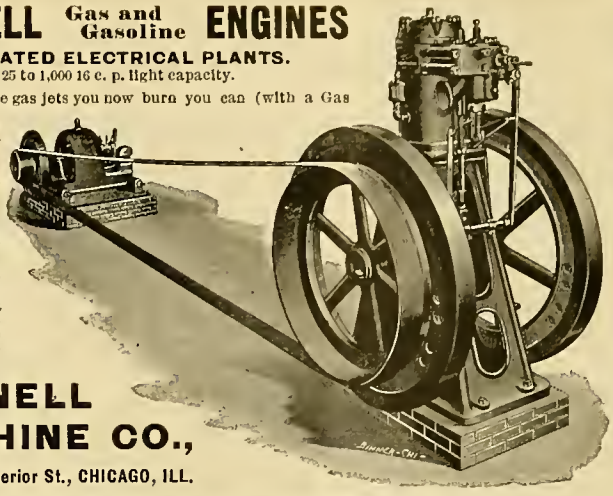

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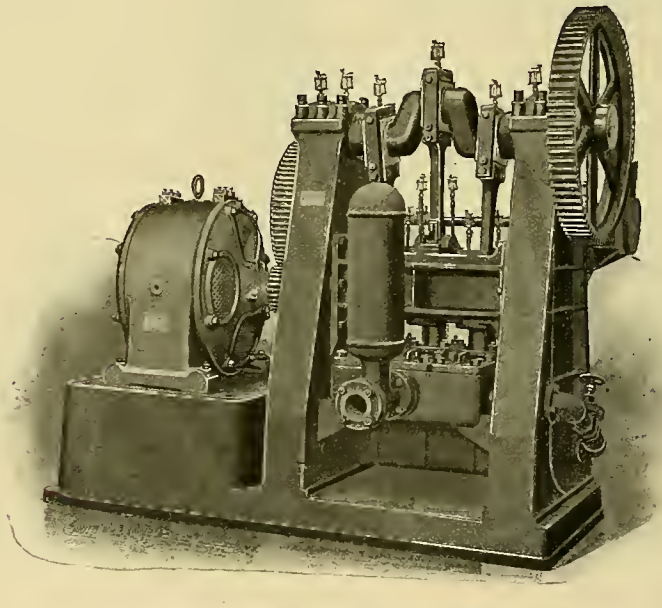

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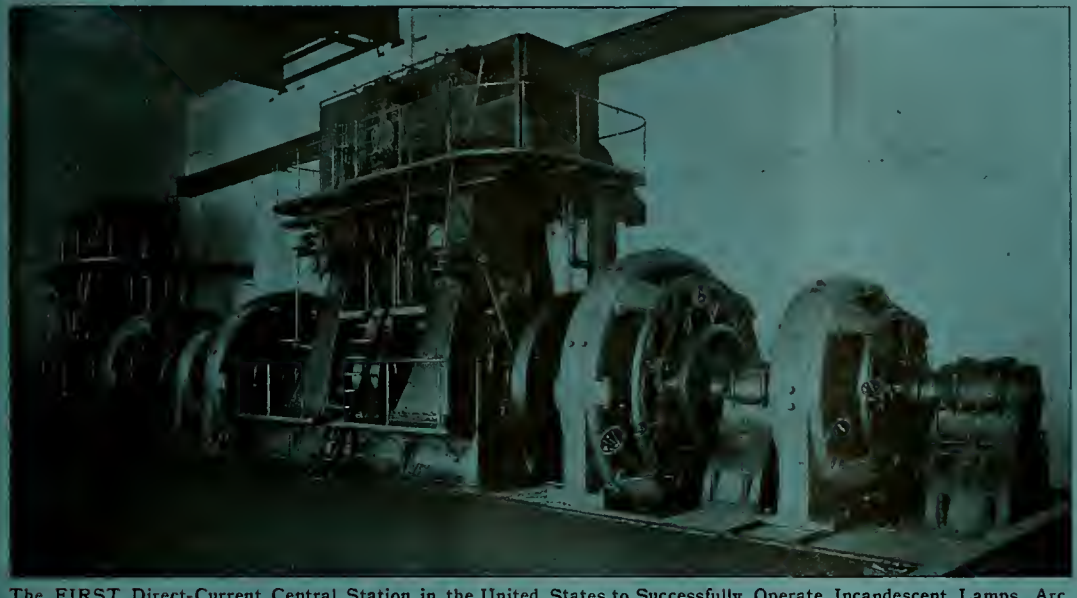

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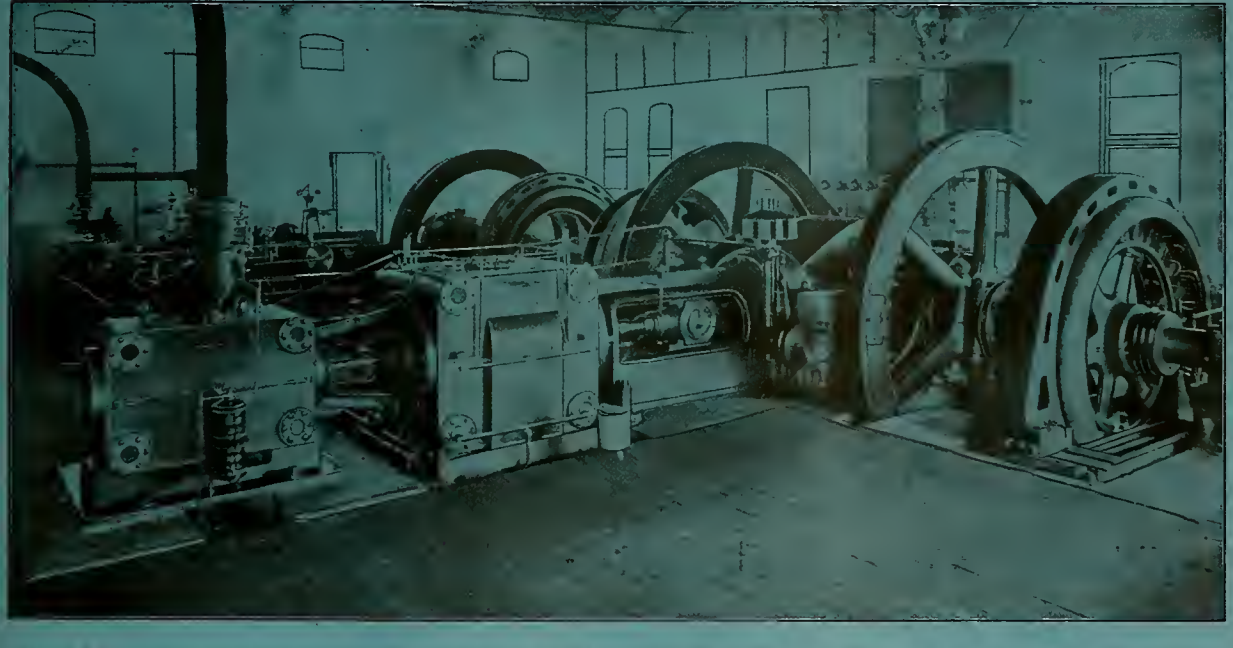

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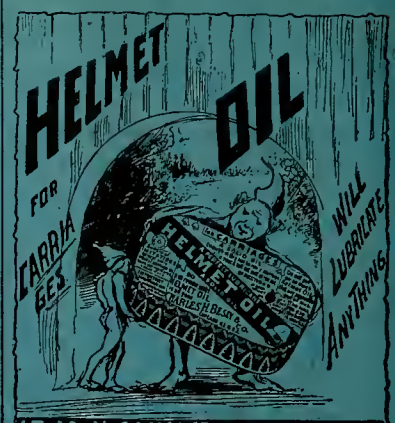

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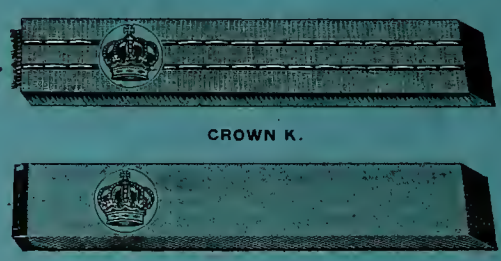

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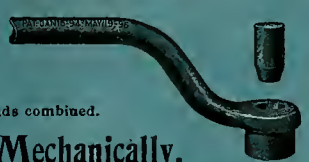

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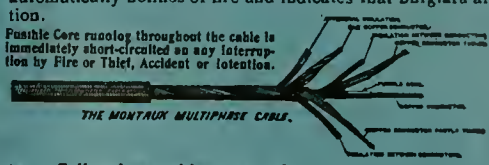

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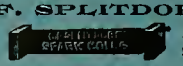

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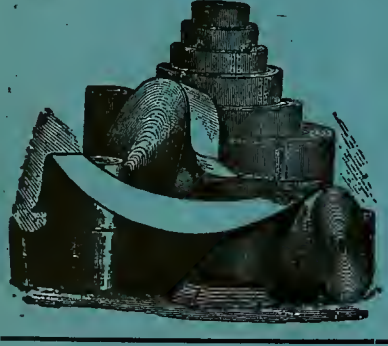

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3	5	6½	8	9½	11½
3½	6¼	7½	9¼	11½	14
4	7½	8½	10½	13	16
4½	8	10	12	14½	18
5	9	11	13	16	20
6	10¾	13	16	19	23½
7	13	15	18½	23	27½
8	15	18	21	26	32
9	17	20	25	30	36
10	19	23	27	33	40
12	23	27	33	41	49
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16	....	38	45	56	67
18	....	43	51	63	76
20	....	48	57	71	85
22	....	....	63	79	95
24	....	....	70	88	$1.05
26	....	....	77	97	1.16
28	....	....	84	$1.05	1.26
30	....	....	91	1.14	1.37
32	....	....	98	1.23	1.47
34	....	....	$1.05	1.32	1.58
36	....	....	1.12	1.40	1.68

LEATHER BELTING.

This belting is all second-hand, and we guarantee it as good as new for use—it will last as long as new belting. We make this a specialty. We have an experienced man who knows everything worth knowing about belting. Anything he buys we guarantee as good as new for use. Compare our prices with new.

Width Inches	Price per ft. Single Thick	Price per ft. Double Thick
1¼	3c	6c
1½	4c	8c
1¾	5c	10c
2	7c	14c
2½	9c	18c
2½	9c	18c
2¾	10c	20c
3	11c	22c
3¼	12c	24c
3½	13c	26c
3¾	14c	28c
4	15c	30c
4½	17c	34c
5	19c	38c
5½	21c	42c
6	24c	46c
6½	27c	54c
7	31c	62c
8	35c	70c
9	39c	78c
10	43c	86c
11	47c	94c
12	51c	$1.02
13	55c	1.10
14	60c	1.20

We sell belting in any quantity. In ordering leather belting, please mention whether you want single or double-thick. If nothing mentioned, will send single-thick belt.

We have the following widths of

DOUBLE LEATHER BELT.

15-inch Double Leather, per foot	$1.19	26-inch Double Leather, per foot	$2.23
16 " " " "	1.28	30 " " " "	3.45
18 " " " "	1 40	40 " " " "	3.75
24 " " " "	1 95	Prices on Larger Sizes on Application.	

Owing to the vast scale on which the electrical lighting at the Omaha Exposition was conducted, we are possessors of the largest stock of Copper Wire, Incandescent Globes and Supplies of every kind that has been offered on the market in recent days. Such a chance as the present one must be fully understood and appreciated by you. It is not merely of passing importance, but you've got to stop and think of it---consider it well.

Do You Need Any Electrical Supplies?

Will you need any Electrical Supplies some time in the future? If so---write at once for our prices. ASK FOR CATALOGUE No. 156. We also publish "THE MONTHLY BULLETIN"---a journal for Wise Buyers. Is your name on our Mailing List?

Chicago House Wrecking Co.,

WEST 35TH AND IRON STREETS, CHICAGO.

For Electric Railways

To obtain increased economy of fuel, labor and repairs—to prevent severe strains upon generating machinery—to reduce liability of breakdowns—to increase station capacity—

USE THE CHLORIDE ACCUMULATOR.

THE ELECTRIC STORAGE BATTERY CO.,

Sales Offices:
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Chicago, Marquette Building. San Francisco, The Parrott Building.

19TH ST. AND ALLEGHENY AVE., PHILADELPHIA, PA.

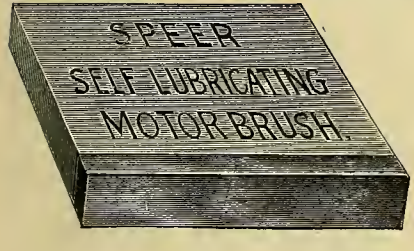
"EBONITE" COMMUTATOR DRESSING.
OLDEST IN MARKET. SAMPLES SENT ON REQUEST.
SINGLE CAKES, 20 CENTS; DOZEN, $1.50.
MNFG. BY E. M. ASHMORE & CO., 40 ENGLEWOOD AVENUE, DETROIT, MICH.

HAVE YOU RECEIVED BULLETIN No. 3005?
REDUCED PRICES ON
"STANDARD" HIGH-GRADE KNIFE SWITCHES
SPECIALLY DESIGNED FOR FINE SWITCHBOARD USE.
The Emerson Electric Mfg. Co., ... St. Louis, Mo.

EAGLE INSULATING VARNISH.
Best made, light colored, remains elastic. Send for sample and be convinced.
Eagle Paint & Varnish Works,
PITTSBURG, PA.

ROEBLING
Rubber Wire and Cables.

25% DIVIDEND.
The rebate we allow on burned-out lamps when either New or Renewed lamps are ordered from us is a 25 per cent. dividend to you.
If you want this dividend write us and we will tell you how to get it.
LYNN INCANDESCENT LAMP CO.,
LYNN, MASS.



CARBON MOTOR AND GENERATOR BRUSHES.

SPEER CARBON CO.,

Andrew Kaul, Pres. Louis Strenber, Vice-Pres.
Andrew Kaul, Jr., Secy. and Treas. J. S. Speer, Gen'l Mgr.
ST. MARYS, PA.

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FOREIGN AND DOMESTIC
CARBONS

WRITE FOR PRICES.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

STILL ANOTHER OF OUR SPECIALTIES.

NEW CATALOGUE NOW READY.

INK WRITING REGISTER,

Formerly known as the Greeley Ink Writing Register,

For Police, Fire Alarm and District Telegraph, or any Special Purpose.

MADE IN SINGLE AND MULTIPLE PEN.

We carry all parts of this Register in stock, such as

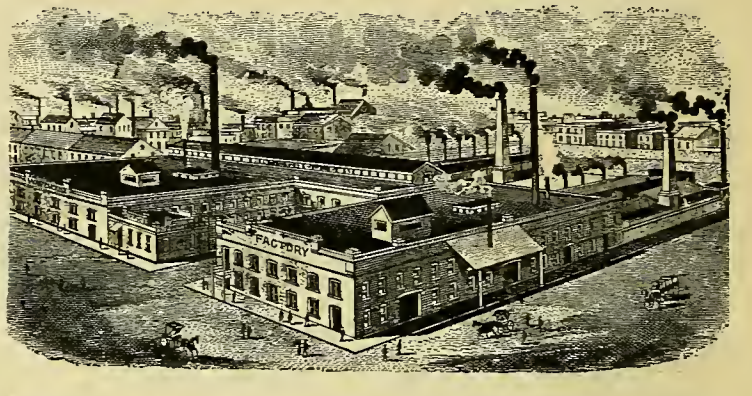
Ink Wheels, Ink Pads, Main Springs, Winding Keys, Etc.

OUR ELECTRICAL LABORATORY IS EQUIPPED WITH THE MOST MODERN APPARATUS FOR DELICATE TESTING, ETC.

FOOTE, PIERSON & CO., NEW YORK,

Manufacturers of Electrical Goods.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

Vitogen

FOR

Wounds

AND

Burns.

Vitogen has proved very successful for treating electrical burns. A great many electricians keep it constantly at hand, as a burn is liable to come at any time. After once trying Vitogen, you would not be without it.

Sold by druggists or mailed on receipt of price; 2 oz., 50c.; 4 oz., $1.00. Canadian price: 2 oz., 60c., 4 oz., $1.20

Manufacturing Chemists, **THE G. F. HARVEY CO.,** Saratoga Springs, N. Y., U. S. A.

Canadian Branch, Mille Roches, Ont., KEZAR & BENNETT, Agents.

Washington, D. C.,

November 15, 1899.

The Non-polsrizing Dry Battery Company,

625 Broadway,

New York.

Gentlemen:

I take great pleasure in stating that as fer as our use of "O. K." dry batteries has gone, they have proven all they are represented to be, and we have adopted them as our standard Dry Cell. We used only this make of dry cells in Cuba and Porto Rico and now use them in the Philippines, they lasting longer than any other make we have ever used.

WAR DEPARTMENT SIGNAL OFFICER NOV 15 1899 DISBURSING OFFICE.

Very truly yours,

Eugene A. Disbrow

Captain & Signal Officer, U. S. Vols., Disbursing Officer.

O. K. DRY BATTERIES

Are O.K.'d By All Users.

Read what a Government War Official says of the O. K. Battery.

They are unequaled for Telephones, Fire and Police Telegraph, Railway Signal Work, Burglar Alarms, Electric Clocks, Gas Engines, Etc., Etc.

Used exclusively by U. S. Signal Corps and Pullman Palace Car Co.

Polarization reduced to a minimum. Unaffected by heat or cold. High voltage and amperage. Great recuperative power. Longest life. Compact. Full strength.

Beware of Imitations.

Other manufacturers endeavor to imitate the shape but cannot approach the quality.

3¼x1x1⅞ 4x1¼x1⅝ 4¾x1½x2 5⅝x1¾x2¼ 6x2x2½ 7x2¼x2¾

NON-POLARIZING DRY BATTERY CO.,

625 Broadway, New York.

CHINA SWITCHES

...FOR...

INSIDE WIRING.

Remove Mechanical Appearance to the aid of Artistic Effect.

China Case Coloring permits Matching or Blending with Woodwork or Wall Tints.

Special Catalogue with net prices will soon be distributed.....

Central Electric Company,

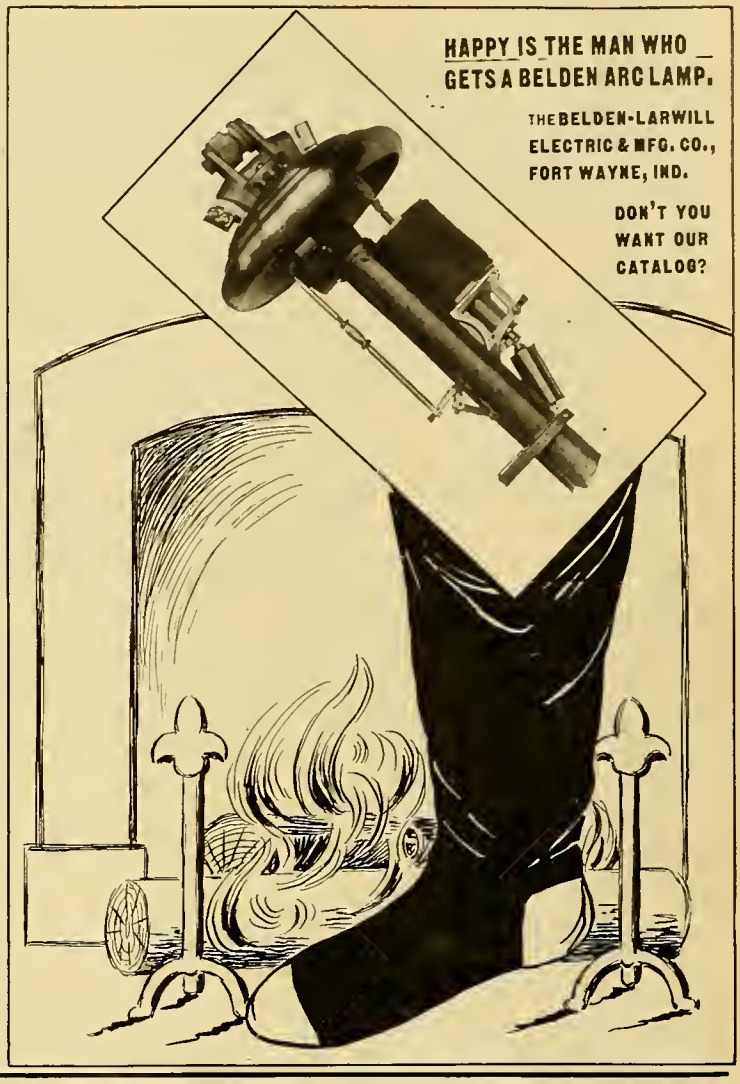
264-270 Fifth Avenue,

CHICAGO, OKONITE IT NEVER DISAPPOINTS *ILLINOIS.*

HAPPY IS THE MAN WHO GETS A BELDEN ARC LAMP.

THE BELDEN-LARWILL ELECTRIC & MFG. CO., FORT WAYNE, IND.

DON'T YOU WANT OUR CATALOG?



PERFECT contact between upper carbon and central tube—supplied through a novel flexible wire arrangement.

Skeleton for solenoids made of vulcabeston, reducing heating effect in coils 25 per cent.

Confinement of all vibration within U-shaped core—an almost absolutely noiseless alternating-current lamp.

Carbons 9½ x ½ inch upper; lower, 5¾ x ½ inch, one cored and one solid.

Length over all 25 inches, or with reflector 24 inches. Weight about 24 lbs.

Life 75 hours, more according to quality of carbons.

Wide range in adjustment, from 50 to 133 cycles on 95 to 125 volts.

Ready access to inner globe and trimming device.

Made for globe or reflector in any finish.

G. I.

New Alternating-Current Enclosed ARC LAMP...

GENERAL INCANDESCENT ARC LIGHT CO.,

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WILL STOP A BELT'S SLIPPING, SO IT CAN RUN EASY.

BUT YOU MAY BELIEVE

LAKE CITIES ELECTRIC RAILWAY CO., Michigan City, Ind.: "Have been using Cling-Surface on our two main engine belts and are very much pleased with it; as these belts were slack they slipped, but now with Cling-Surface on them, we have no trouble and they run finely."

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WE CAN GIVE YOU PLENTY MORE. ASK US ABOUT CLING-SURFACE.

CLING SURFACE MFG. CO., 177-182 VIRGINIA STREET..... **Buffalo, N. Y.**

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Chicago Belting Co.
Leather Preserver Mfg. Corp.
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Standard Underground C. Co.
Western Elect. Supply Co.

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National Carbon Co.
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Schiff, Jordan & Co.
Speer Carbon Co.
Western Elect. Supply Co.

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Harvey Co., The G. F.

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Leonard, Ward, Elec. Co.

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Chicago Insulated Wire Co.
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General Electric Co.
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Standard Underground C. Co.
Western Elect. Supply Co.

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Int Correspond. Schools.
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Woods Motor Vehicle Co.

Electrical and Mechanical Engineers.
Arnold El. Power Station Co.
Bain, Foree.
Bryan & Humphrey.
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Elbridge Elec. Mfg. Co.
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Ohio Electric Works.
Pacific Electric Co.
Plass, E. H., Electric Co.
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The Lamp Will Do The Rest.

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	125 VOLTS.					
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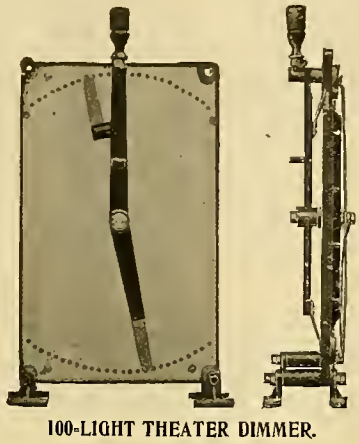
PRICE	$4.20	$5.80	$7.30	$16.40	$24.50	$33.00



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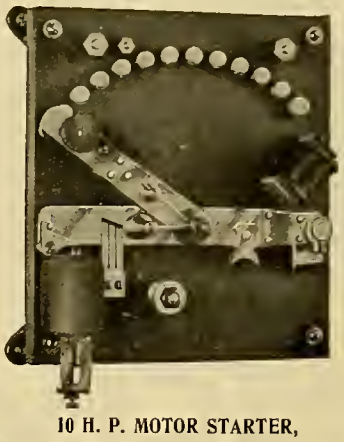

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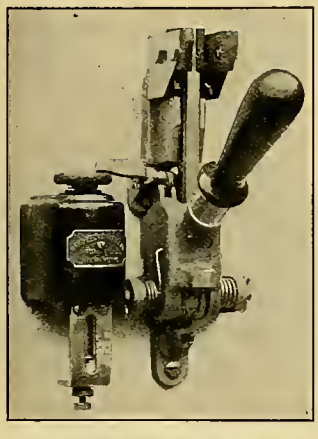

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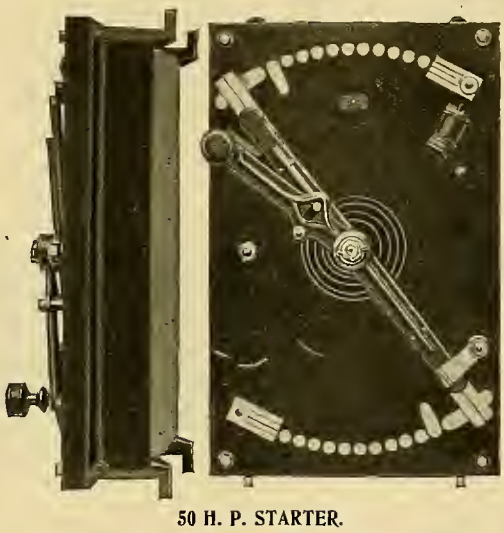

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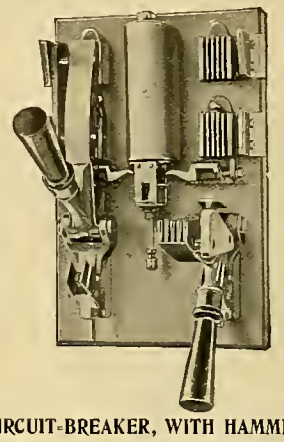

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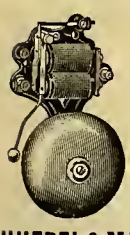

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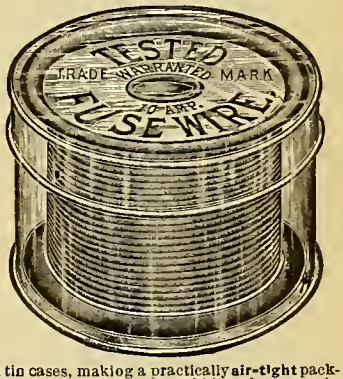

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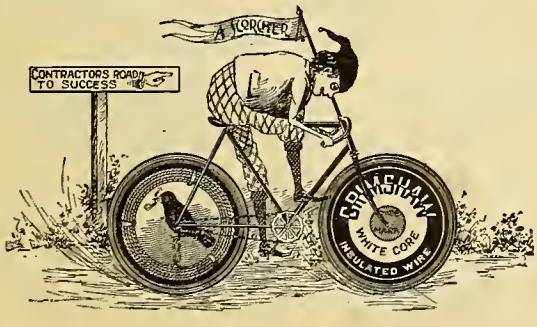

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RELATING TO INCANDESCENT LAMPS.

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AMERICA'S LARGEST ELECTRICAL SUPPLY HOUSE.

A COMMUTATOR NECESSITY!

50 CENTS PER STICK. $5.00 PER DOZEN.

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ABSOLUTELY WILL NOT GUM THE BRUSHES. . . .

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Sole Manufacturers,

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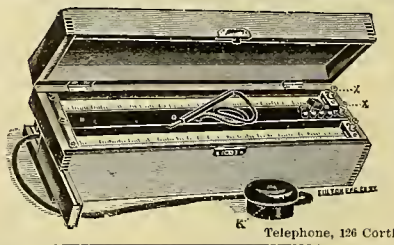

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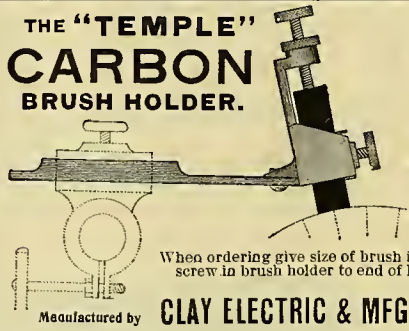

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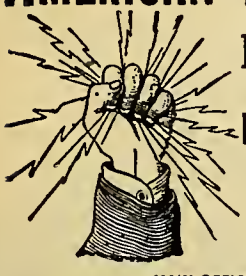

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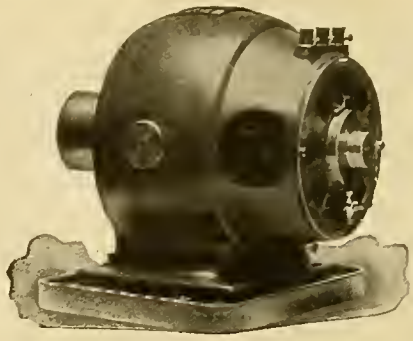

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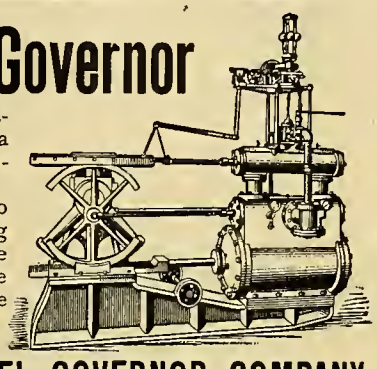

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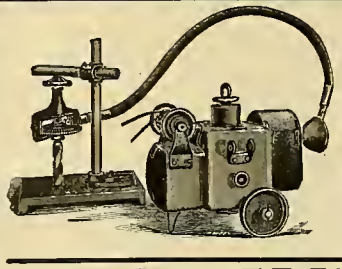

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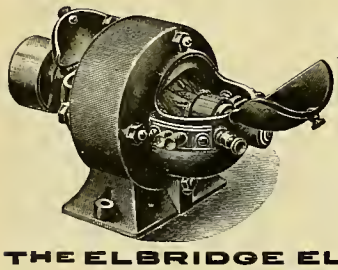

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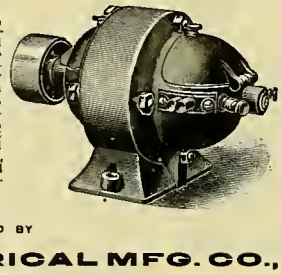

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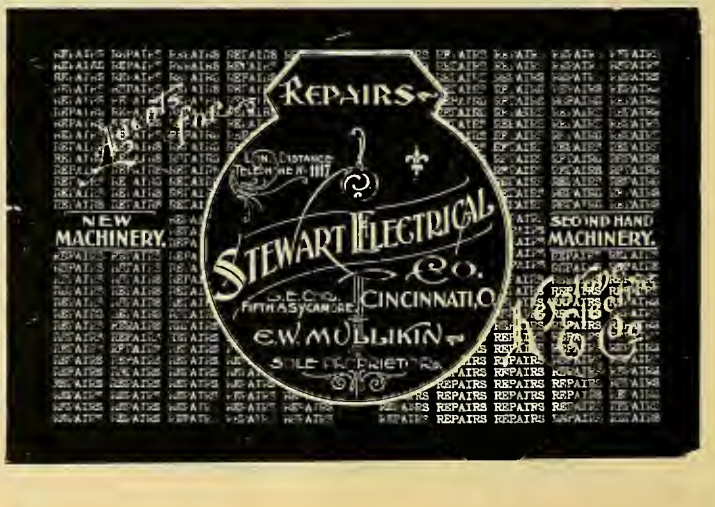

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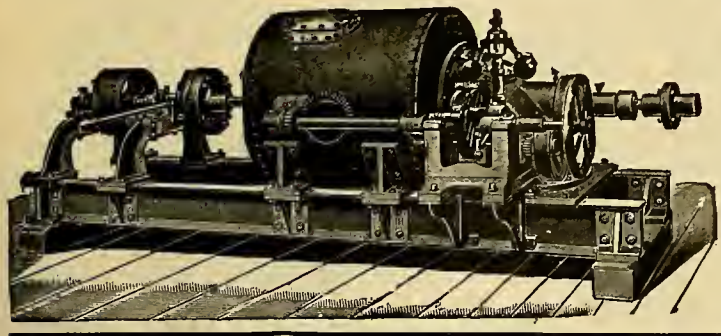

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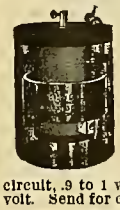

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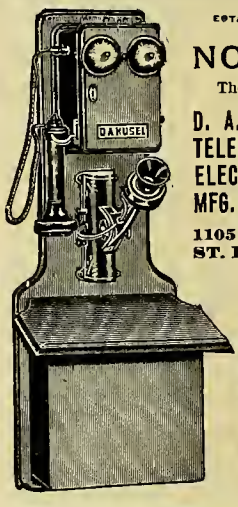

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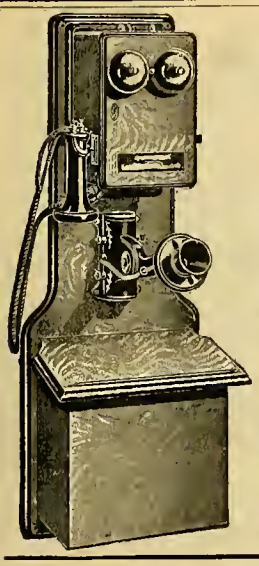

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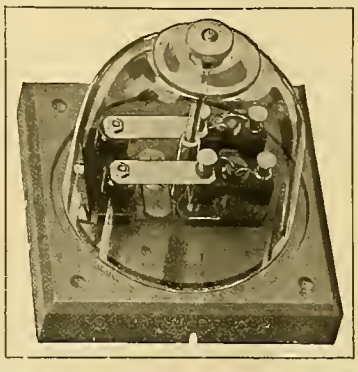

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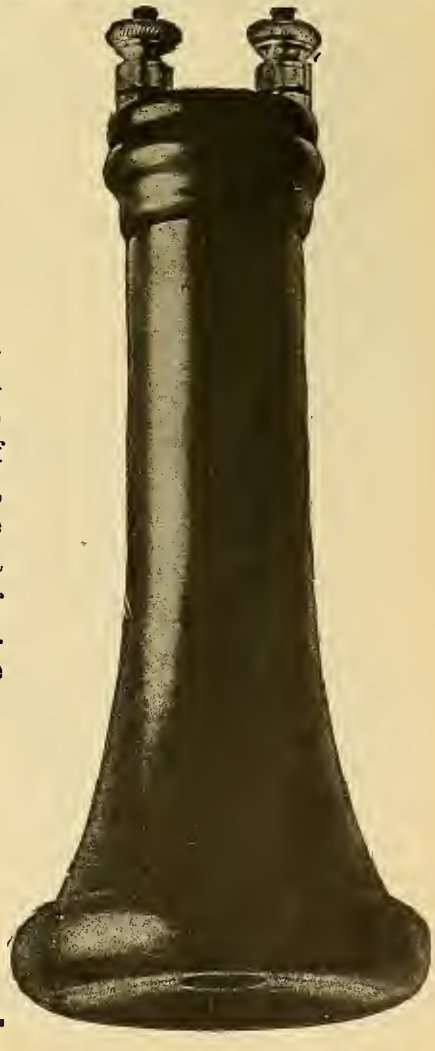

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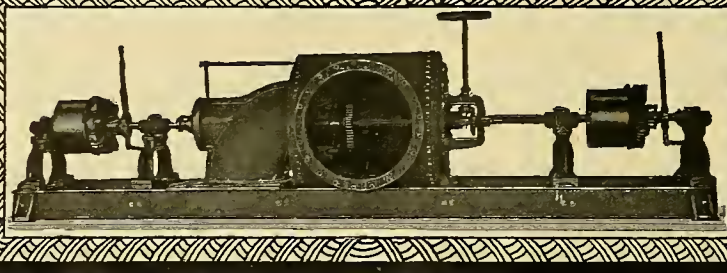

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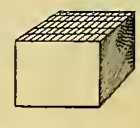

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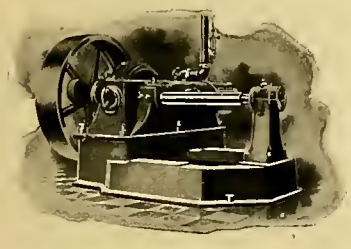

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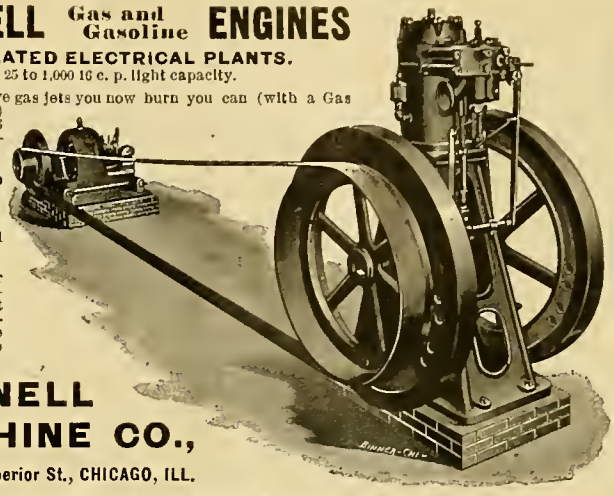

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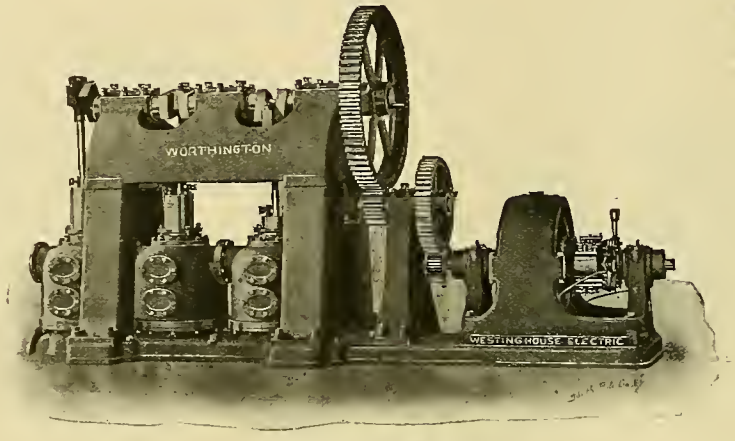

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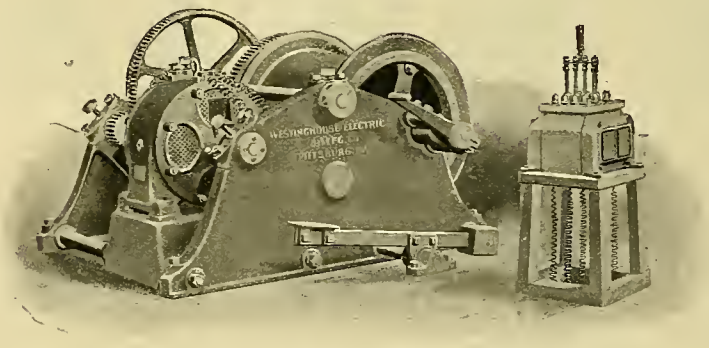

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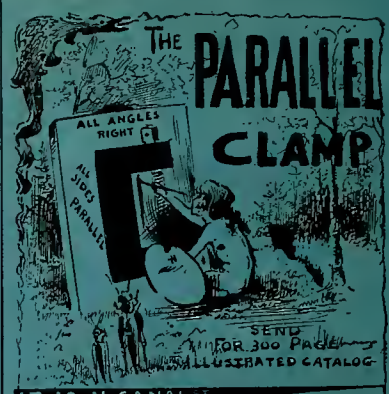

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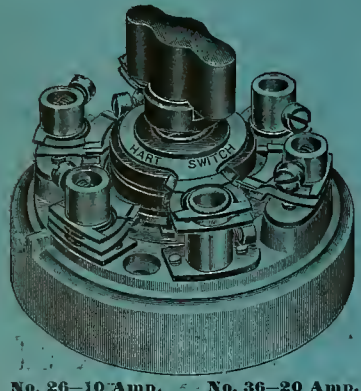

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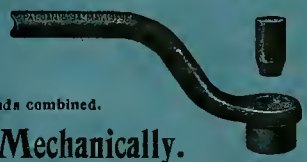

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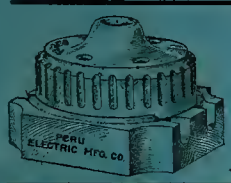

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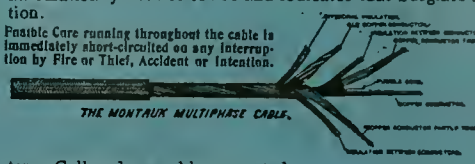

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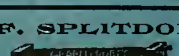

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MAKERS OF LEATHER BELTING — RELIANCE — DEALERS IN MILL SUPPLIES

DYNAMO BELTING.

The production of our Dynamo brand of leather belting is the result of patient inquiry and careful study of the requirements of the different machines used under all conditions and in all climates.

When ordering Dynamo Belting always state the system used.

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NEW ORLEANS ST. LOUIS MEMPHIS

WE BUY AND SELL

SECOND-HAND ELECTRICAL MACHINERY.

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WANTED FOR CASH. We pay $15.50 per Ounce For Scrap. PLATINUM SHEET AND WIRE FOR SALE.

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GOLDSMITH BROS., 63 and 65 Washington St., CHICAGO. Works, 58th and Throop Sts., REFINERS and ASSAYERS. Highest prices paid for old Incandescent Lamp Bases.

LAVA WASHERS. LAVA BUSHINGS. LAVA THREADED PIECES.

Combine High Heat Resistance with BEST INSULATING QUALITY.

Send drawing or model for estimate.

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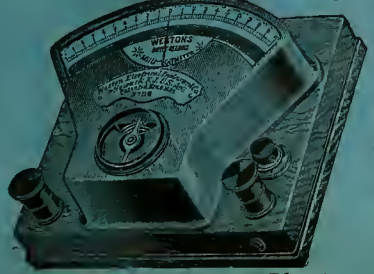
Weston Standard Portable Direct Reading Voltmeters, Millivoltmeters, Voltammeters, Ammeters, Milliammeters, Ground Detectors and Circuit Testers, Ohmmeters, Portable Galvanometers.



Weston Standard Portable Direct

Our Portable Instruments are recognized as The Standard the world over. The Semi-Portable Laboratory Standards are still better.

Our Station Voltmeters and Ammeters are unsurpassed in point of extreme accuracy and lowest consumption of energy.

Mention the WESTERN ELECTRICIAN when writing

THE BEST—THE "NEW STYLE" Receptacle and Attachment Plug.

The latest in this line is the "NEW STYLE" made by

WM. T. PRINGLE, 1026 Filbert Street, PHILADELPHIA.

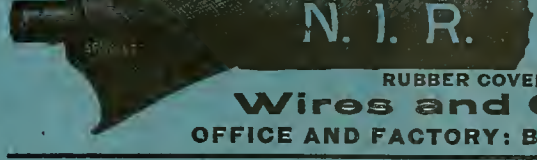
Western Representatives: J. B. McKeague Co., 324 Dearborn St., Chicago.

25% DIVIDEND.

The rebate we allow on burned-out lamps when either New or Renewed lamps are ordered from us is a 25 per cent. dividend to you.

If you want this dividend write us and we will tell you how to get it.

LYNN INCANDESCENT LAMP CO., LYNN, MASS.



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OFFICE AND FACTORY: BRISTOL, R. I.

GENUINE ERICSSON SWEDISH COAL-GRAIN MICROPHONE

THE PERFECT TRANSMITTER.

NO PACKING OR ADJUSTING.

WE SELL A COMPLETE LINE LONG DISTANCE TELEPHONES.

ERICSSON TELEPHONE CO.

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1,000,000 sold during the past twelve months.

Mesco Dry Battery.

Acknowledged the Best Dry Cell Manufactured.

Price each, 40c.

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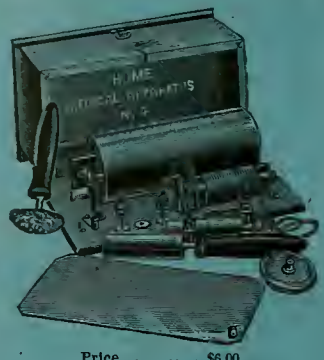
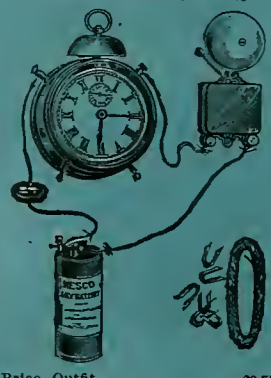
We make all sizes.



Price.....$6.00

We make a number of different styles.

Alarm Clock Outfit, No. 1½.



Price, Outfit $3.75

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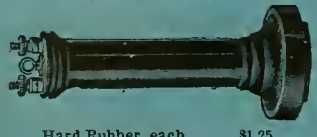
Will register the strength of open or closed circuit batteries.

Price each, $3.50.

Telephone Receivers.



Hard Rubber, each.....$1.25

Telephone Outfit, No. 14,

With our high-grade carbon transmitter, which will be sent on approval to responsible parties.

Price, with two cells Mesco Dry Battery, $9.00.

Pony Telephone Receiver.

Retail price, 90 cents.

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Price.....$9.00

We make 3 dozen different Telephone Outfits.

Iron Box Bells, No. 97.

2½, 3, 3½ and 4 inch. Special prices

Battery Zincs.

We have purchased the plant of the Carr Metal Company and can furnish the Carr composite zincs in all forms and quality heretofore supplied by that company.

OUR PRICES given above do not fairly represent quotations to the trade or to parties ordering quantities.
WE MANUFACTURE a large percentage of the goods found in our catalogue.

Catalogue No. 11—Now Ready.

MANHATTAN ELECTRICAL SUPPLY CO., 32 CORTLANDT STREET, NEW YORK.

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MARTIN J. INSULL CO.

CHICAGO: 1012-1013 Monadnock Block. MINNEAPOLIS: 813 Guaranty Bldg MILWAUKEE: 700 Pabst Bldg.

Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

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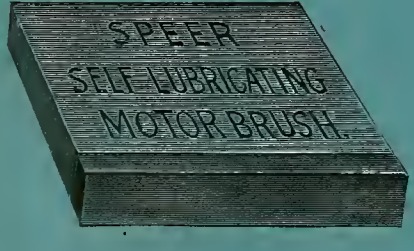

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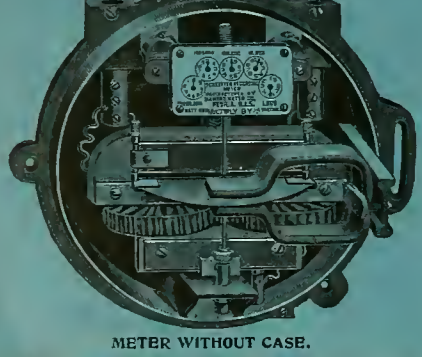

METER WITHOUT CASE.

Accurate on All Loads.
Will Start and Register Correctly on 5 Watts.
Shunt loss LESS than one Watt on 60 Cycles.
Dust Proof.
Correct on All Inductive Loads.

DIAMOND METER CO.,

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METER WITH CASE.

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."

Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

EAGLE INSULATING VARNISH.

Best made, light colored, remains elastic. Send for sample and be convinced.

Eagle Paint & Varnish Works,
PITTSBURC, PA.

INCANDESCENT LAMPS

That maintain their Candle Power and produce a Pure White Light, because they have

A PERFECT VACUUM.

Made of the Highest Grade Materials, and by Latest Process known. Quality Guaranteed.

Prices F. O. B., Owensboro, Ky., 8, 10, 16 C. P., Bbl. Lots, 17c each. 32 C. P., Bbl. Lots, 25c each. Either E., T.-H. or W. H. Bases.

TRY A BARREL AND BE CONVINCED.

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KENTUCKY ELECTRICAL CO., OWENSBORO, KENTUCKY.
INCORPORATED.

The Vetter Current Tap.

A Tapping Plug and Lamp Socket Combined.

For Sale By All Electrical Supply Houses.

Send For Descriptive Circular and Discount Sheet.

A simple and safe device for tapping and carrying the current from any electric light fixture to Motors, Drop-lights and other electrical devices WITHOUT THE LOSS OF LAMP IN FIXTURE. Adapted to any system of electric lighting. When ordering, state what socket is used. Each tap is packed, with full directions, in a neat box.

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This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Cut-Outs Knife Switches, Jenkins Snap Switches, etc. **Guarantees Satisfaction**

PHILADELPHIA. **H. T. PAISTE CO.** CHICAGO.

CHICAGO INSULATED WIRE CO.

152-154 Lake St.
CHICAGO, ILL. U.S.A.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

JANUARY 3, 1900

Is the day the WESTERN ELECTRICIAN's New Year's Issue will go to press. A special page or half-page announcement in it will enable you to properly place your goods before the thousands of prospective buyers reached exclusively by the WESTERN ELECTRICIAN.

Send in your order and copy **To-Day.**

COLUMBIA CARBONS

FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

NATIONAL CARBON COMPANY,

1198 West Madison Avenue,
CLEVELAND OHIO.

CARBONS

FOR

Direct and Alternating Incandescent Arc Lamps.

IMPORTED ELECTRA NUERNBERG.

TRADE MARK

A large line in stock,
CORED and SOLID.

These carbons are the best made
and, when used with our

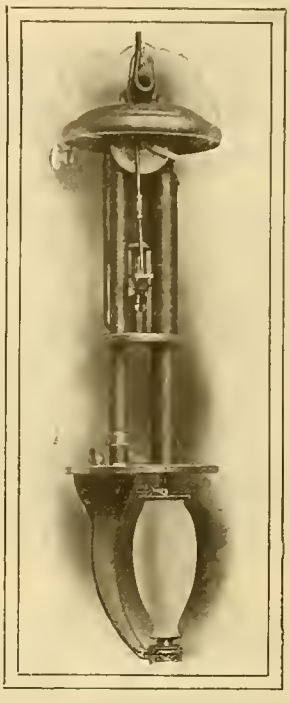
ZECO ARC LAMPS,

assure perfect light.

Central Electric Company,

264-270 Fifth Avenue,
CHICAGO.

OKONITE IT NEVER DISAPPOINTS



THE

Start the New Year right by using the "Belden" Arc Lamp. It will prove a paying investment.

BELDEN

It will burn a minimum of 150 hours with a single 12x½-inch carbon. "There's a saving."

ARC

It can be trimmed while hot and as easy as an open arc. This does away with breakages. "There's a saving."

LAMP

It has no complicated parts, therefore requires less attention than any lamp on the market. "There's a saving."

We pay the postage on our catalog. "There's a saving."

—THE—

BELDEN-LARWILL Electric & Mfg. Co.,

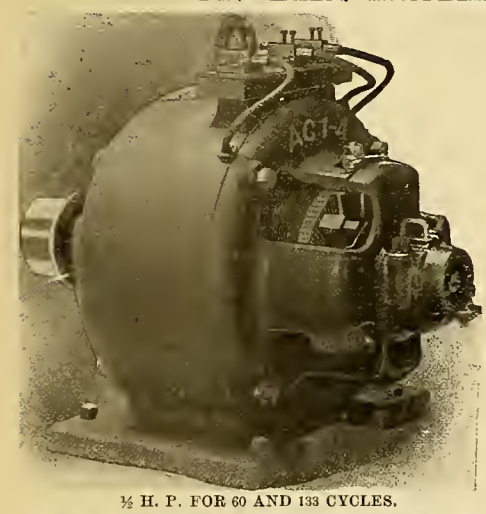
FT. WAYNE, IND., U. S. A.

Watch This Space

FOR THE

LATEST and BEST ELECTRICAL APPARATUS

ON THE MARKET.



½ H. P. FOR 60 AND 133 CYCLES.

Our ½ H. P. Single-Phase Self-Starting A. C. Motors ARE THE LATEST addition to our well-known list of standard sizes.

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BULLETIN 32,
JUST ISSUED.

WAGNER ELECTRIC MFG. CO.,

General Offices and Factory, ST. LOUIS, U. S. A.

Builders of—	Bulletin.
Switchboards for Lighting and Power Transmission	20
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BOSTON, 620 Atlantic Avenue, H. C. Buck, Agent.
CHICAGO, 1519 Marquette Bldg., Geo. B. Foster, Agent.
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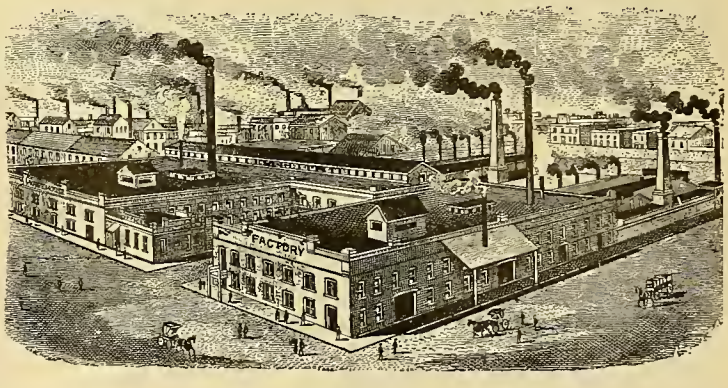
SAN FRANCISCO, 120 Sutter St., A. R. Pike, Agent.
DALLAS, TEXAS, James M. Boyle, Agent.
YOKOHAMA, JAPAN, Bagnall & Hilles, Agents.
LONDON, ENGLAND, 47 Victoria St., C. R. Heap, Agent.
CITY OF MEXICO, American Engineer's Co. of Mexico, Agt.

PHOENIX



We Are Still Doing Business

at the old stand, and desire to announce to the trade that we are running full time and manufacturing and selling everything in the battery and specialty line.

We have discontinued the manufacture of electric light carbons and street railway motor brushes of every description.

Our products ARE THE BEST.

Our facilities are UNSURPASSED.

We are in a position to MAKE PRICES to meet the requirements of the times or COMPETITION of the World.

Our stock is complete, and we solicit your business.

PHOENIX BATTERY MFG. CO.,

ST. LOUIS, MO.

THE LIGHTS FLICKER BECAUSE THE BELTS SLIP IN ELECTRIC-LIGHT STATIONS

And the Power is unequal.
Belts filled with Cling-Surface do NOT slip, but run steadily and smoothly. Because they do not slip they can be relieved of tension and run easy, yet will transmit at least fifteen per cent. more power. Cling-Surface is not a belt dressing, but is a belt filler, and does not make a sticky belt—yet they never slip. And Cling-Surface is one of the BEST BELT PRESERVATIVES KNOWN. Your belts are valuable, and you are afraid of belt dressings but so are the BELTS of Fraser & Chalmers, Chicago; Union Traction Co., Philadelphia; American Steel and Wire Co., Worcester, Mass., and General Electric Co. Lamp Works, and they use and value Cling-Surface. Let us tell you more about it.

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NEW ENGLAND BRANCH: 170 SUMMER STREET, BOSTON.

CLING-SURFACE MFG. CO., 177-182 Virginia St., BUFFALO, N. Y.

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Chicago Belting Co.
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Harvey Co., The G. F.

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Cutter Elec. & Mfg. Co.
Ward Leonard Elec. Co.

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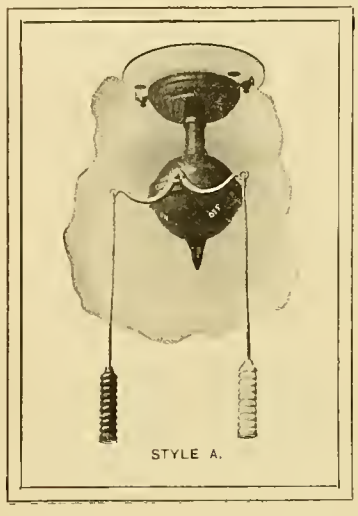

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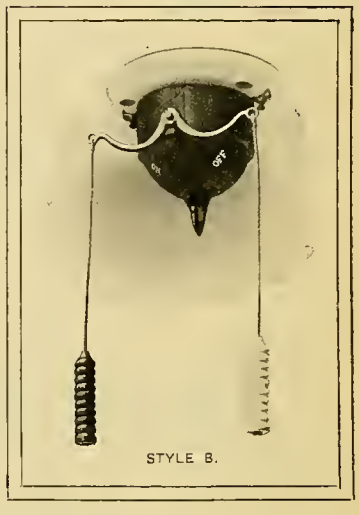

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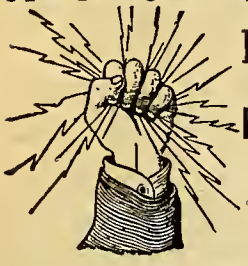

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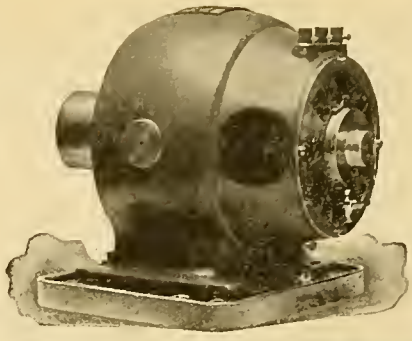

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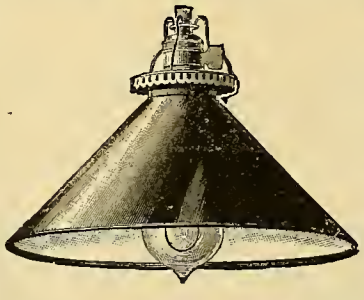

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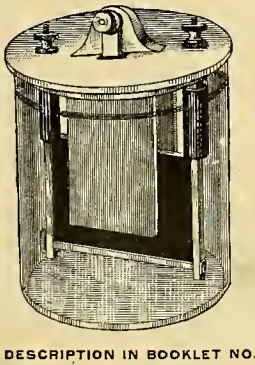

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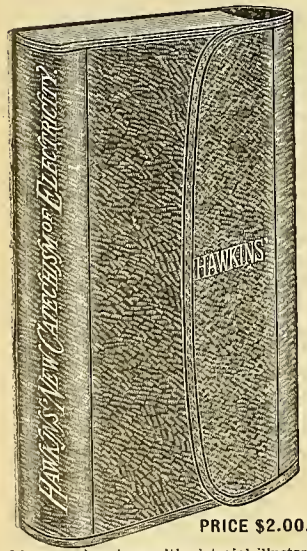

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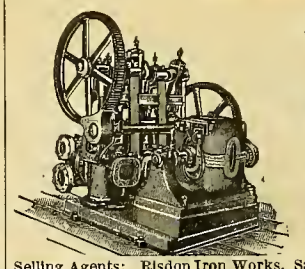

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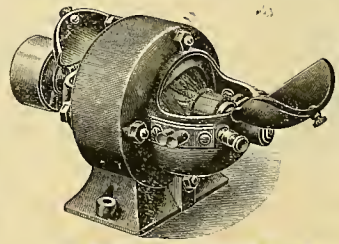

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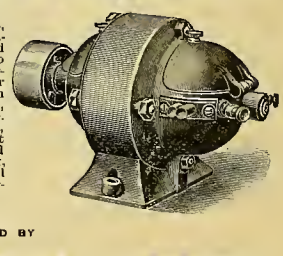

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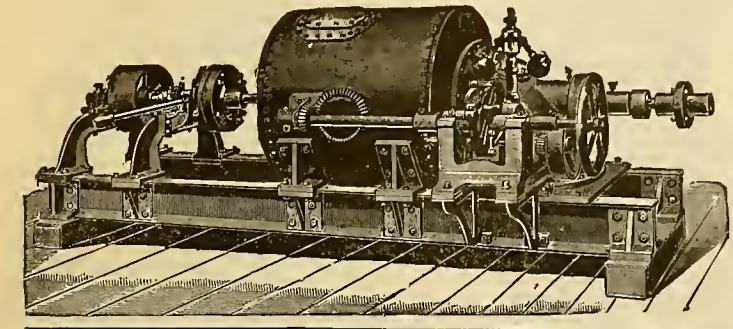

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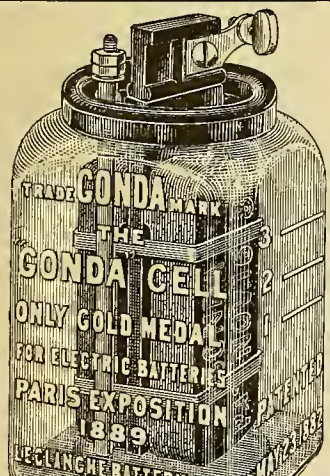

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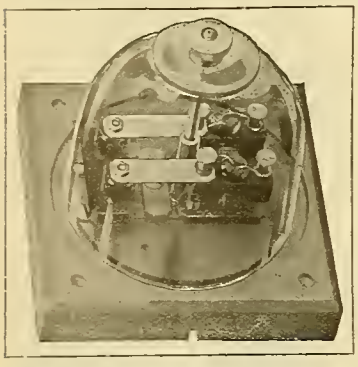

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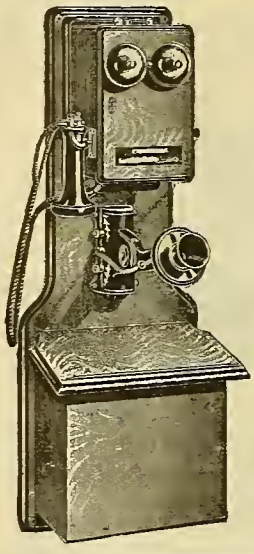

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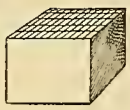

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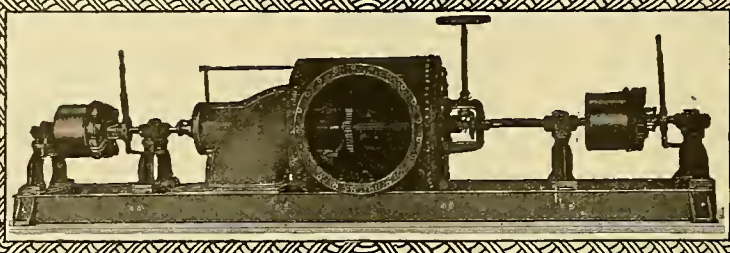

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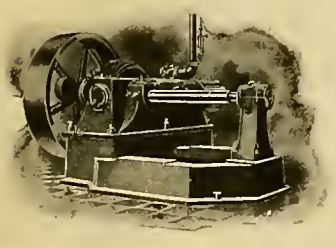

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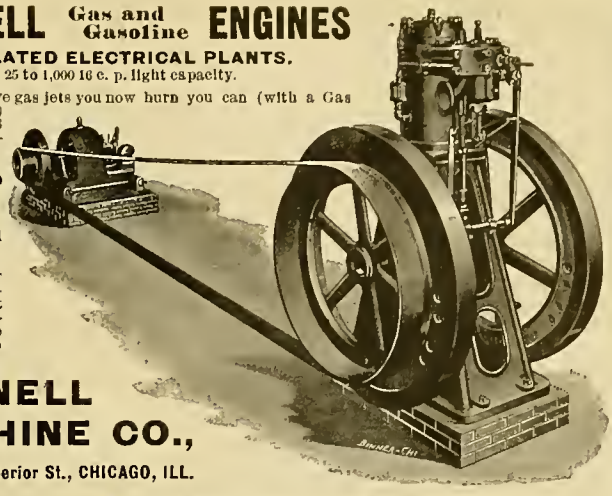

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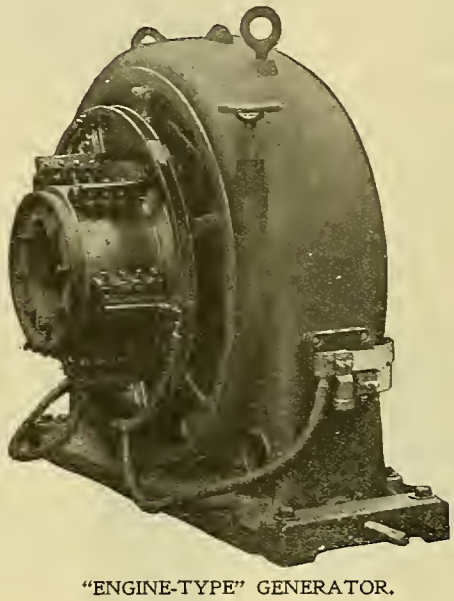

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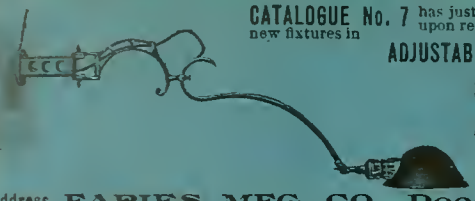

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